Allen-Bradley

# CompactLogix™ System

(Catalog Numbers 1769-L20 and 1769-L30)

## User Manual

Rockwell Automation

File Name: AB_CompactLogix_1769_L20_L30_user_D601

## Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.



Throughout this manual we use notes to make you aware of safety considerations:

| | |
|---|---|
| **ATTENTION** Or **WARNING** | Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss |

Attention and warning statements help you to:

- identify a hazard
- avoid a hazard
- recognize the consequences

| | |
|---|---|
| **IMPORTANT** | Identifies information that is critical for successful application and understanding of the product. |

The information below summarizes the changes to this manual since the last printing.

To help you find new and updated information in this release of the manual, we have included change bars as shown to the right of this paragraph.

The table below lists the sections that document new features and additional or updated information on existing features.

In addition, information on the features, specifications, and operation of the new CompactLogix5330 controller has been added throughout the manual.

| For this information | See |
|---|---|
| Using 1769 I/O Thin Module Profiles | |
| quickstart example | Chapter 1 |
| application example | Appendix H |
| Table of System Protocol Options | page 4-2 |
| Information on using 1761-NET-AIC with CompactLogix in Class I, Div. 2 environments | page 4-4 |
| Advice on using CompactLogix on DH-485 networks | page 5-1 |
| Battery life estimates for CompactLogix controllers | Appendix C |
| Execution times for CompactLogix5330 | Appendix D |
| Equations and examples for calculating I/O scan times | page D-17 |
| An application example using CompactLogix controllers on Ethernet | Appendix G |
| An application example using 1769 Generic and Thin I/O Module Profiles with CompactLogix | Appendix H |
| An example showing Messaging on DH485 with SLC 5/03 and CompactLogix controllers | Appendix I |

## Chapter 3

**Placing, Configuring, and Monitoring Local I/O**



## Chapter 4

**Communicating with Devices on a Serial Link**

## Appendix I

**Messaging On DH-485 with SLC 5/03, CompactLogix5320 and CompactLogix5330 Controllers**



## Index

Read this preface to familiarize yourself with the rest of the manual. This preface covers the following topics:

- who should use this manual
- how to use this manual
- related publications
- conventions used in this manual
- Rockwell Automation support

## Who Should Use This Manual

Use this manual if you are responsible for designing, installing, programming, or troubleshooting control systems that use Allen-Bradley CompactLogix™ controllers.

## How to Use This Manual

As much as possible, we organized this manual to explain, in a task-by-task manner, how to install, configure, program, operate and troubleshoot a CompactLogix control system.

## Related Documentation

The table below provides a listing of publications that contain important information about CompactLogix systems.

| For | Read this document | Document number |
|---|---|---|
| Information on installing the CompactLogix5320 and CompactLogix5330 controllers | CompactLogix™ Modular Processors | 1769-IN047B-EN-P |
| An technical overview of the CompactLogix system | CompactLogix™ Technical Data | 1769-TD003B-EN-P |
| Information on common procedures using RSLogix 5000 software. | Logix5000 Controllers Common Procedures Programming Manual | 1756-PM001C-EN-P |
| Indepth information on the CompactLogix Instruction Set | Logix5000 Controllers General Instruction Set Reference Manual | 1756-RM003D-EN-P |
| Information on function block programming Logix controllers. | Logix5000 Controllers Process Control/Drives Instruction Set Reference Manual | 1756-RM006A-EN-P |
| Information on installing, configuring, and using Compact Analog I/O modules | Compact I/O Analog Modules User Manual | 1769-UM002A-EN-P |
| Information on using the 1769-ADN DeviceNet Adapter. | Compact I/O 1769-ADN DeviceNet Adapter | 1769-UM001A-US-P |
| In-depth information on grouding and wiring Allen-Bradley programmable controllers. | Allen-Bradley Programmable Controller Grounding and Wiring Guidelines | 1770-4.1 |

If you would like a manual, you can:

- download a free electronic version from the internet at **www.theautomationbookstore.com**
- purchase a printed manual by:
  - contacting your local distributor or Rockwell Automation representative
  - visiting **www.theautomationbookstore.com** and placing your order
  - calling 1.800.963.9548 (USA/Canada) or 001.330.725.1574 (Outside USA/Canada)

## Conventions Used in This Manual

The following conventions are used throughout this manual:

- Bulleted lists (like this one) provide information not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.
- *Italic* type is used for emphasis.

## Rockwell Automation Support

Rockwell Automation offers support services worldwide, with over 75 Sales/Support Offices, 512 authorized distributors and 260 authorized Systems Integrators located throughout the United States alone, plus Rockwell Automation representatives in every major country in the world.

### Local Product Support

Contact your local Rockwell Automation representative for:

- sales and order support
- product technical training
- warranty support
- support service agreement

## Technical Product Assistance

If you need to contact Rockwell Automation for technical assistance, please review the information in Appendix B, CompactLogix Troubleshooting, first. Then call your local Rockwell Automation representative.

## Your Questions or Comments on the Manual

If you find a problem with this manual, please notify us. If you have any suggestions for how this manual could be made more useful to you, please contact us at the address below:

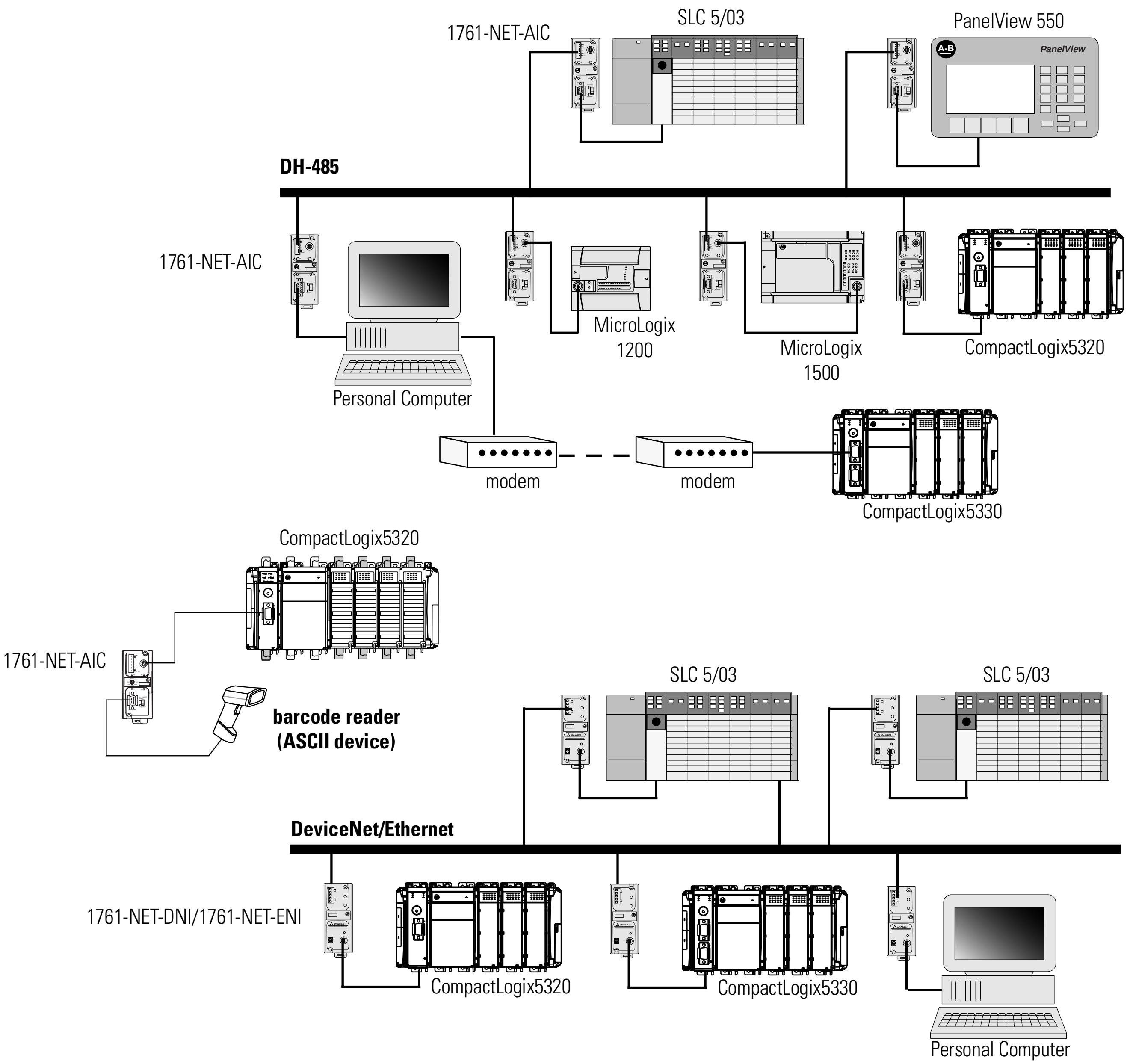
Rockwell Automation
Automation Control and Information Group
Technical Communication, Dept. A602V
P.O. Box 2086
Milwaukee, WI 53201-2086

# Getting Started

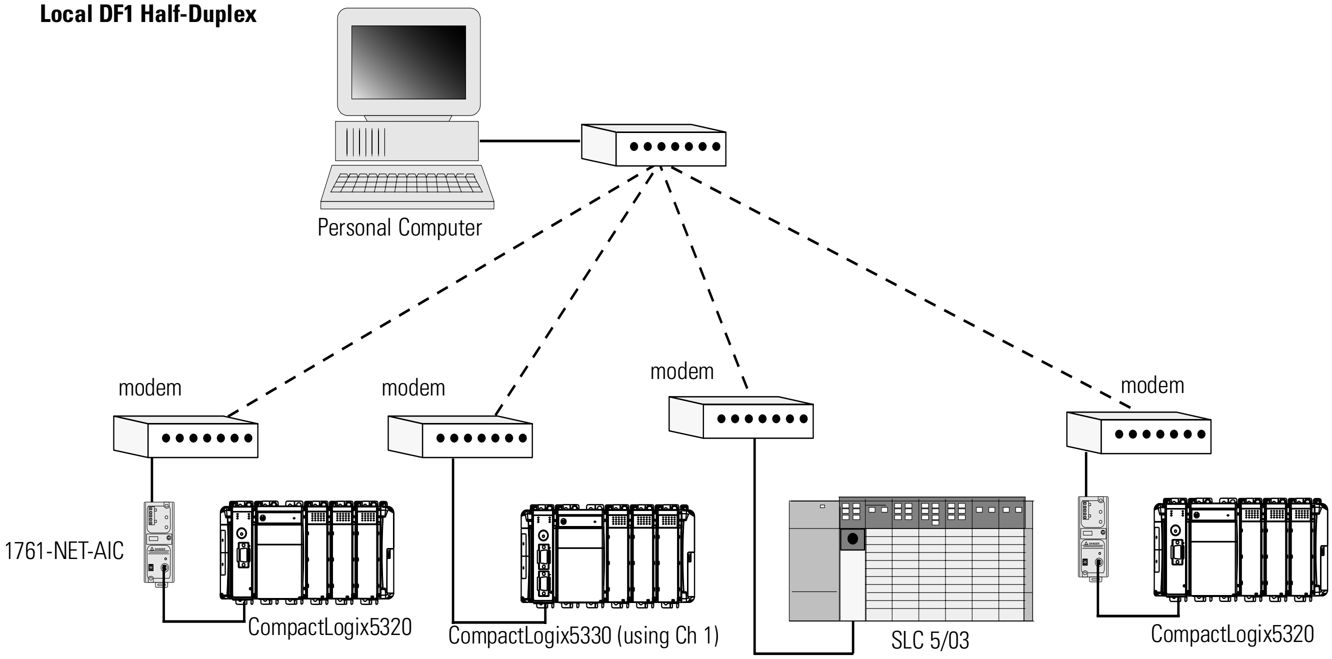
## Introduction

This chapter introduces the CompactLogix controller and provides a quick overview on creating and downloading a project. The steps in this chapter introduce the basic aspects of the CompactLogix controller.

The CompactLogix controller offers state-of-art control and I/O modules in a small cost-effective package.



**Local DF1 Half-Duplex**




The CompactLogix systems above illustrate some of the CompactLogix controller's capabilities. CompactLogix systems feature the following:

- Communications over DH-485, DeviceNet, or Ethernet via peer-to-peer messaging.
- RTU functionality using dial-up modems and DF1 Full-Duplex protocol.
- RTU functionality with radio frequency or leased-line modems and DF1 Half-Duplex protocol.
- Local RS-232 connection(s) for controller project upload/download, DF1 Full-Duplex communications, DH-485 networking, or for ASCII communications.
- Remote programming over DH-485, DeviceNet, and Ethernet.

## CompactLogix5320 vs. CompactLogix5330

The following table illustrates some of the differences between the two available CompactLogix controllers.

| Specification | CompactLogix5320 | CompactLogix5330 |
|---|---|---|
| Communication Ports | (1) RS-232 | (2) RS-232 |
| User Memory | 64K bytes | 256K bytes |
| Max. number of I/O modules supported | 8 I/O modules | 16 I/O modules |
| Max. number of I/O banks supported | 2 banks | 3 banks |

## Compliance to European Union Directives

This product has the CE mark and is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives.

### EMC Directive

This product is tested to meet Council Directive 89/336/EEC Electromagnetic Compatibility (EMC) and the following standards, in whole or in part, documented in a technical construction file:

- EN 50081-2
  EMC - Generic Emission Standard, Part 2 - Industrial Environment
- EN 50082-2
  EMC - Generic Immunity Standard, Part 2 - Industrial Environment

This product is intended for use in an industrial environment.

### Low Voltage Directive

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN 61131-2 Programmable Controllers, Part 2 - Equipment Requirements and Tests.

For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as the following Allen-Bradley publications:

- *Industrial Automation Wiring and Grounding Guidelines for Noise Immunity*, publication 1770-4.1
- *Guidelines for Handling Lithium Batteries*, publication AG-5.4
- *Automation Systems Catalog*, publication B113

## Safety Considerations

Safety considerations are an important element of proper system installation. Actively thinking about the safety of yourself and others, as well as the condition of your equipment, is of primary importance. We recommend reviewing the following safety considerations.

### Hazardous Location Considerations

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only. The following WARNING statement applies to use in hazardous locations.

**WARNING**

EXPLOSION HAZARD

- Substitution of components may impair suitability for Class I, Division 2.
- Do not replace components or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
- Do not connect or disconnect components unless power has been switched off or the area is known to be non-hazardous.
- This product must be installed in an enclosure. All cables connected to the product must remain in the enclosure or be protected by conduit or other means.
- All wiring must comply with N.E.C. article 501-4(b).

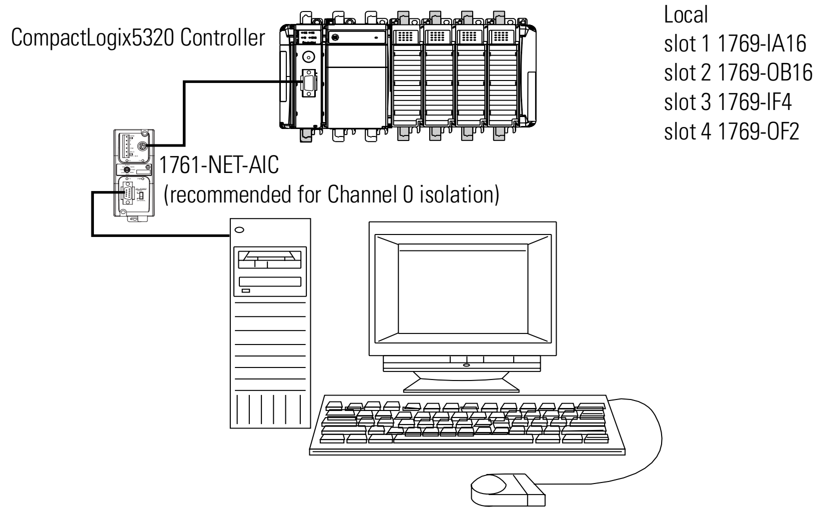
## Creating and Downloading a Project

Follow the steps below to create and download a project. The remainder of this chapter provides examples of each step.

### Quickstart Steps

| | |
|---|---|
| **1. Create a Project** | page 1-6 |
| **2. Configure I/O Modules** | page 1-8 |
| **3. Configure the CompactBus** | page 1-13 |
| **4. Create Tags** | page 1-14 |
| **5. Enter Logic** | page 1-17 |
| **6. Download a Project** | page 1-19 |
| **7. View Status** | page 1-21 |

## System Setup For This Quick Start




You need:

- RSLogix 5000 programming software
- RSLinx communication software
- DF1 point-to-point, serial connection from the workstation to the controller (using 1756-CP3 or 1747-CP3 cable)
- 1761-NET-AIC
  (recommended for Channel 0 isolation)

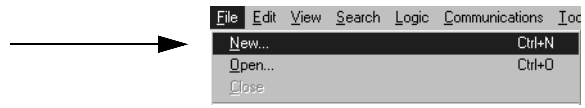
**TIP**

If you are using a CompactLogix5330 controller, you do not need to use an isolator. Channel 1 on the CompactLogix5330 is an isolated RS-232 port.

If you don't have this hardware, you can still follow these steps. Substitute the I/O modules you have for the ones listed here and make the appropriate changes.

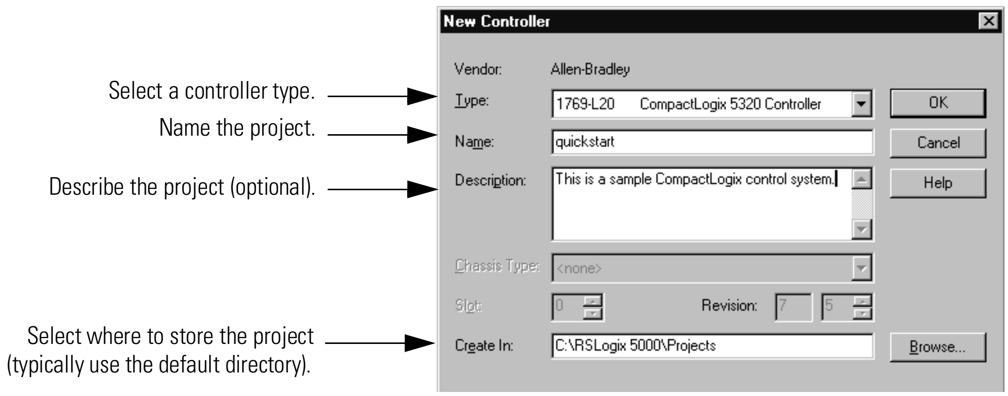
## Create a Project

1. Select File → New.



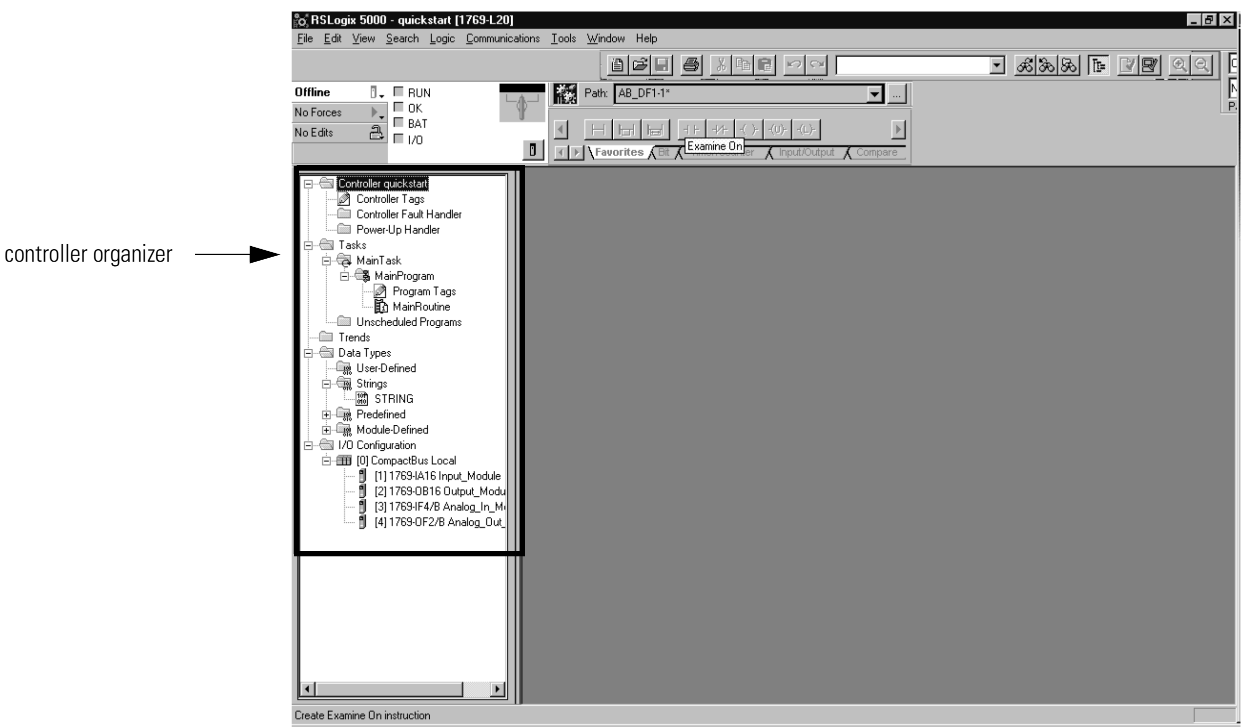

2. Define the project.

The software uses the project name you enter with an .ACD extension to store your project.




Click OK.

The software creates the new project and displays:

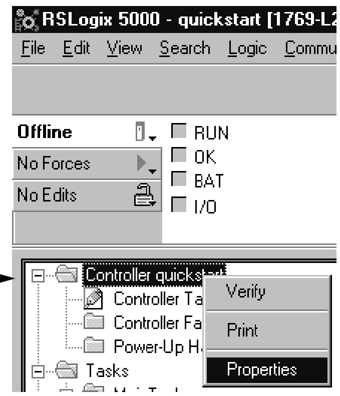


## Changing Project Properties

1. View properties for Controller quickstart.

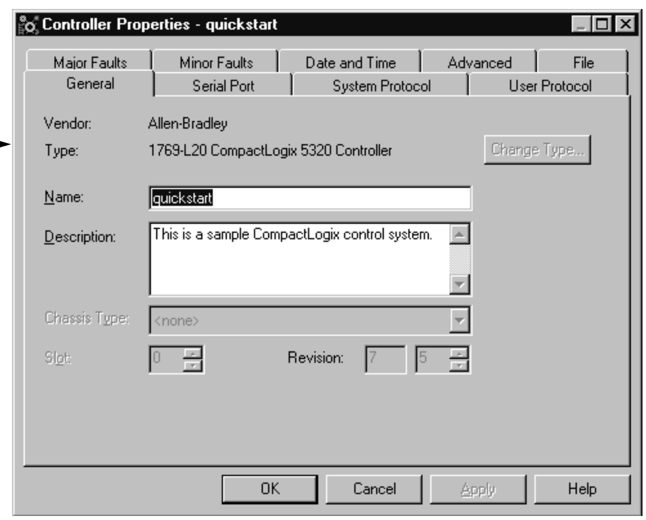
   a. Place the cursor over the Controller quickstart folder.

   b. Click the right mouse button and select Properties.




2. View the General tab. The screen defaults to the General tab.

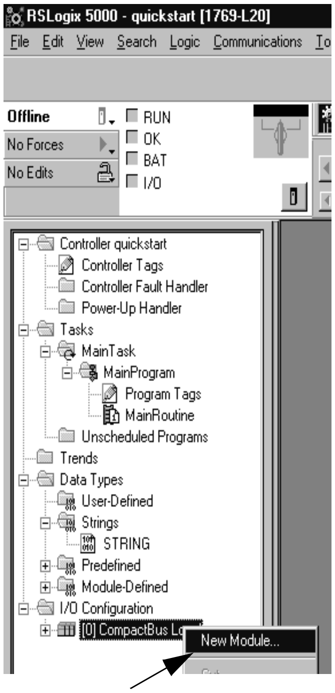
Verify that the controller settings are correct. Make changes if necessary.




Click OK.

# Configure I/O Modules

## Adding a Local I/O Module



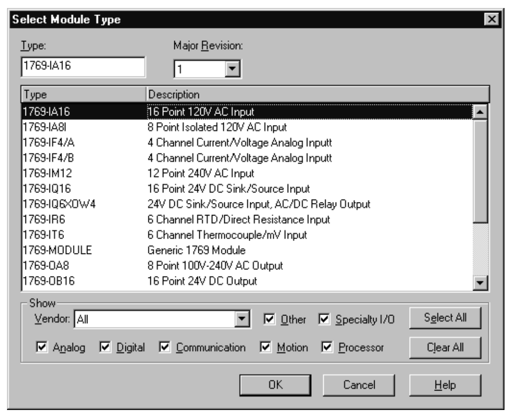

**TIP** You need to add a local I/O module to the project for every module connected to your controller.

**1.** Create a new module.

a. Place the cursor over the [0] Compact Bus Local.

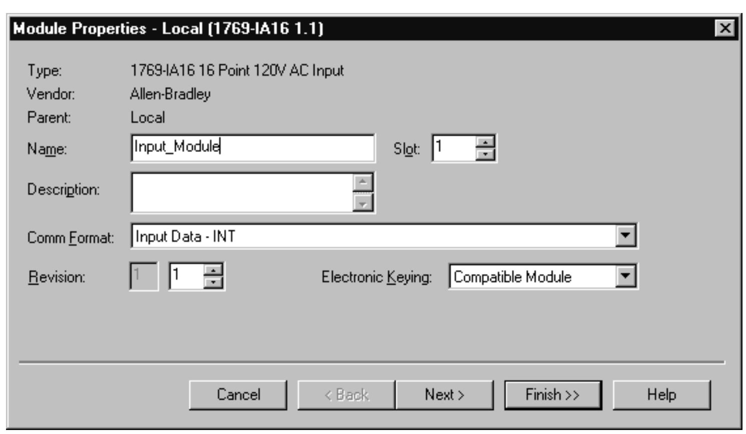
b. Click the right mouse button and select New Module.

**2.** Select the module type from the list of modules.




Click OK.

**3.** Enter a name and description (optional) for the module.




Click Next.

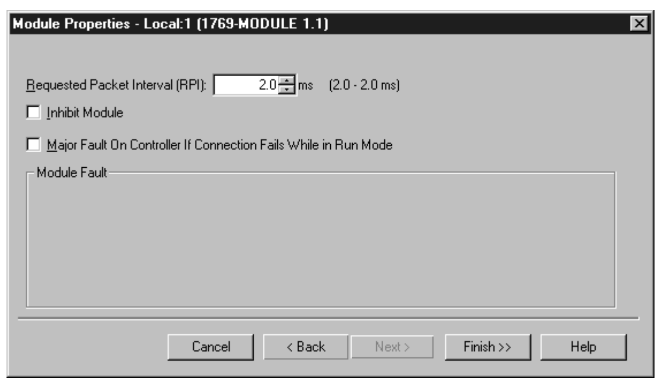
**TIP** The above example shows the settings for 1769-IA16 in slot 1. The accessible fields change depending upon the type of module chosen. Discrete input modules are not configurable. For additional information and 1769 generic/thin module application examples, see Appendix H, Configuring I/O with the 1769 Generic or Thin Profiles.

4. Click on “Next” screen. Using this screen, you can inhibit or uninhibit each module.

**IMPORTANT** Although you can select and de-select the “Major Fault On Controller If Connection Fails While in Run Mode” option, it will not effect controller operation. The controller’s response to a connection failure of any I/O module is fixed to always fault the controller.

See Configuring the Module’s Response to a Connection Failure on page 3-10 and Inhibiting I/O Module Operation on page 3-8 for more information on these functions.

Click Finish.



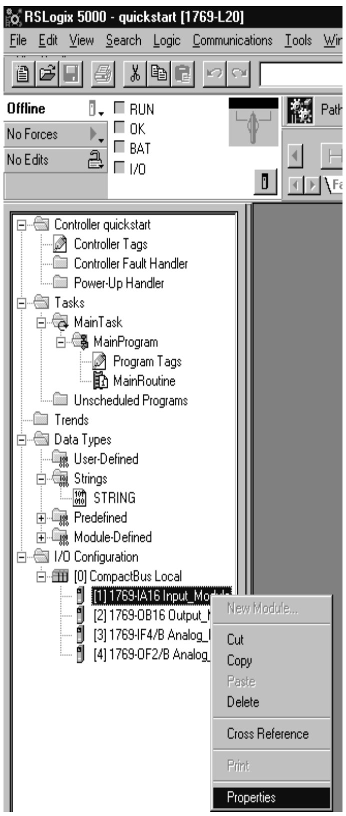

5. Repeat steps 1 through 4 for each I/O module in your system.

**IMPORTANT** Hold last state and user-defined safe state data for outputs are not supported by CompactLogix5320 or CompactLogix5330. If an I/O module fails such that its communication to the controller is lost, or if any module is disconnected from the system bus while under power, the controller enters the fault mode and all outputs turn off.

Outputs turn off whenever the controller is placed in Program mode as well.

**TIP**

See Appendix H, Configuring I/O with the 1769 Generic or Thin Profiles, for additional information on configuring I/O modules with Thin and Generic Profiles.




## Changing Module Properties

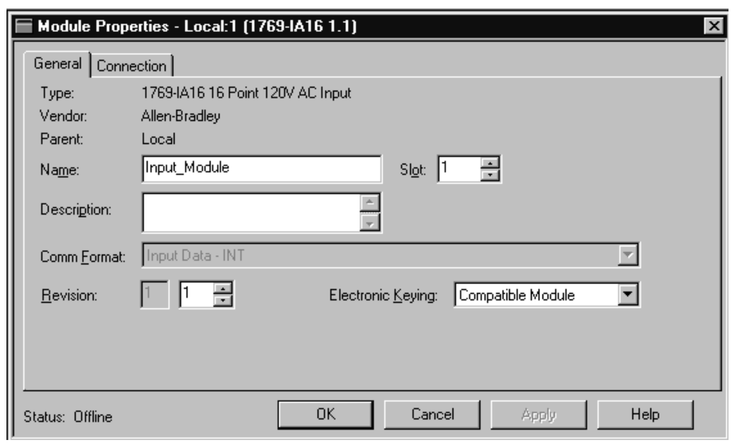
**1.** View Properties for the module.

a. Place the cursor over the 1769-IA16 module.

b. Click the right mouse button and select Properties.

**2.** The screen defaults to the General Tab.

Verify that the module settings are correct. Make changes if necessary.




The parameters that appear on this General tab depend on the type of module.

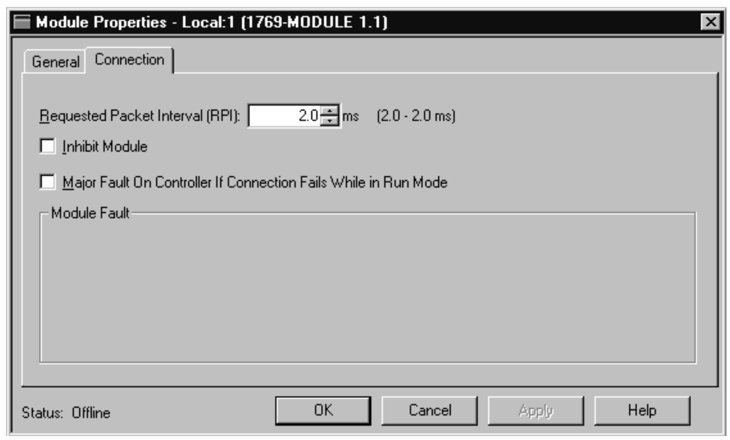
**TIP**

For information and application examples on thin and generic profiles, see Appendix H, Configuring I/O with the 1769 Generic or Thin Profiles.

3. View the Connections tab. Using this screen, you can inhibit or uninhibit each module.

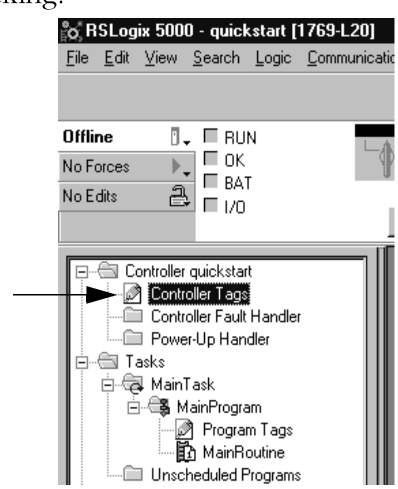
**IMPORTANT** Although you can select and de-select the "Major Fault On Controller If Connection Fails While in Run Mode" option, it will not effect controller operation. The controller's response to a connection failure of any I/O module is fixed to always fault the controller.

See Configuring the Module's Response to a Connection Failure on page 3-10 and Inhibiting I/O Module Operation on page 3-8 for more information on these functions.

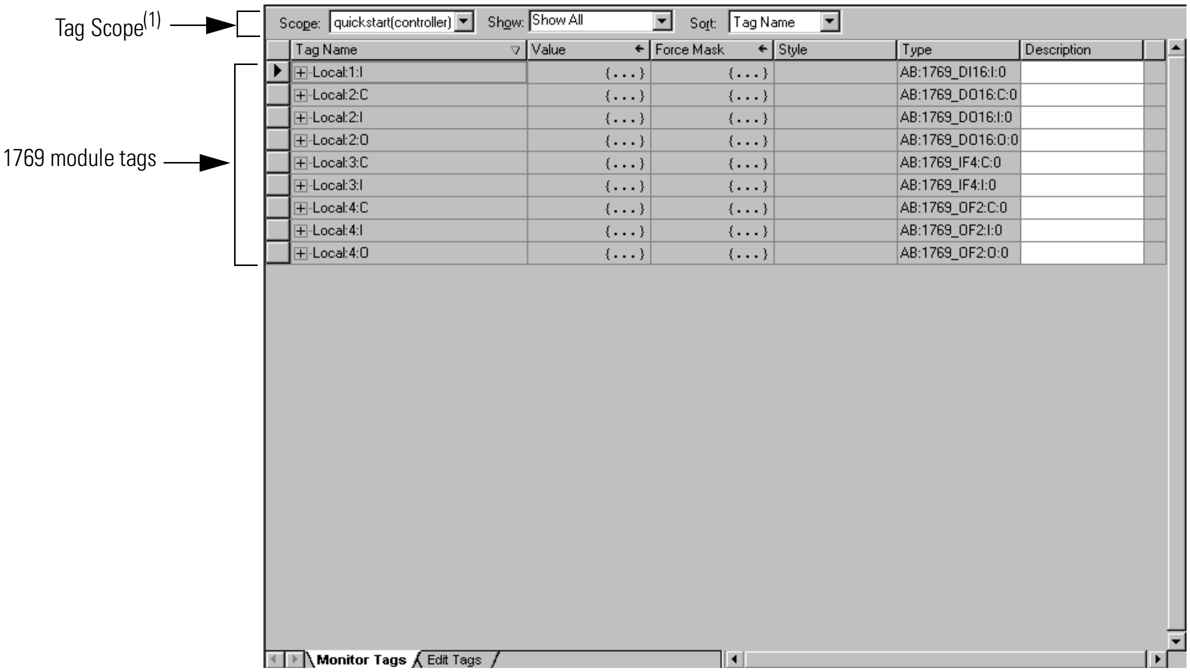



## Viewing I/O Tags

View the tags for the controller by placing the cursor over the Controller tags folder and double-clicking.

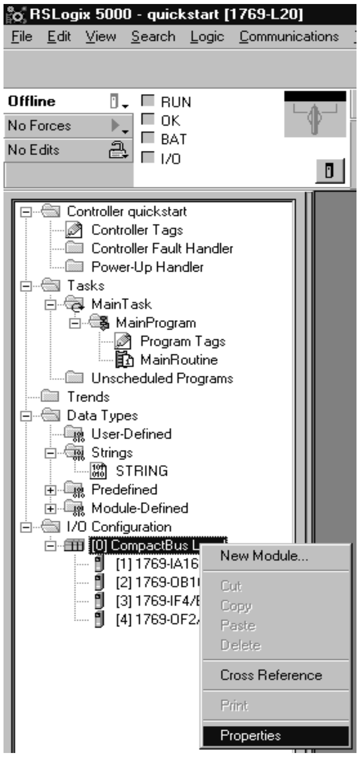


The software displays the module-defined tags for the I/O modules you created.




(1) Tag scope allows tag name uniqueness to be limited to a single scope (controller or program). Thus, the same tag name can be used in many programs without ambiguity.

## Configure the CompactBus

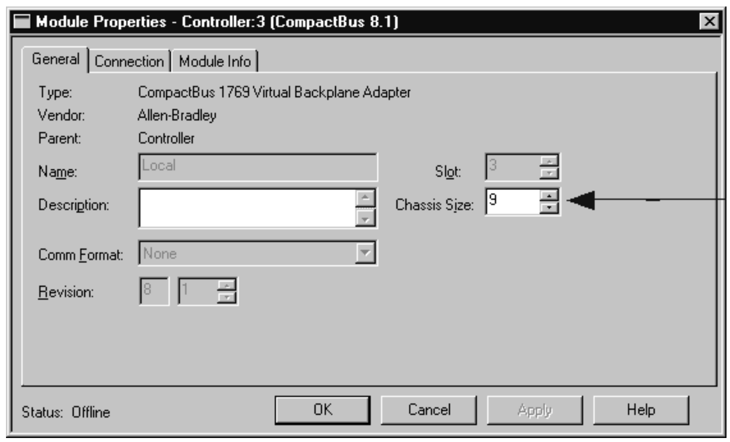



1. In the Controller Organizer, select the CompactBus. Right-click and select Properties.

2. Specify the configuration options.

   Specify the size of the chassis. Enter the number of modules you plan to install. Include the CompactLogix controller in this total.

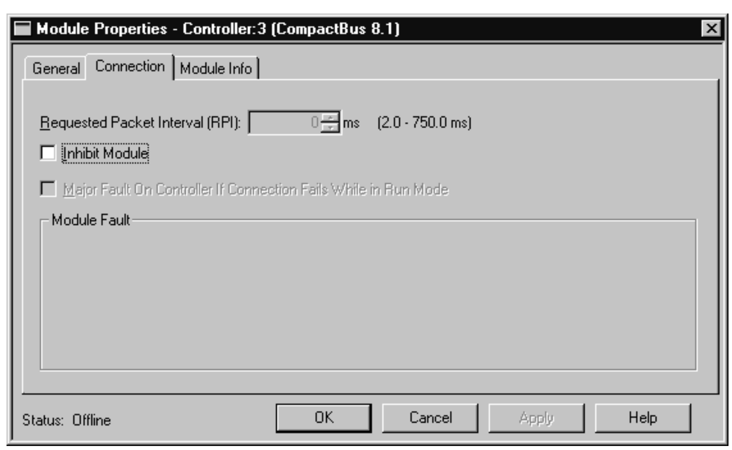
   If the total of your I/O modules and the controller is less than 9, there is no need to decrease this number. The system will operate the same. If you decrease this number and want to add an I/O module to your system later, you will need to remember to increase the chassis size at that time.




3. View the Connections tab.

   You can inhibit and uninhibit the CompactBus. By inhibiting and uninhibiting the CompactBus, you can write new configuration data to the entire system at once.

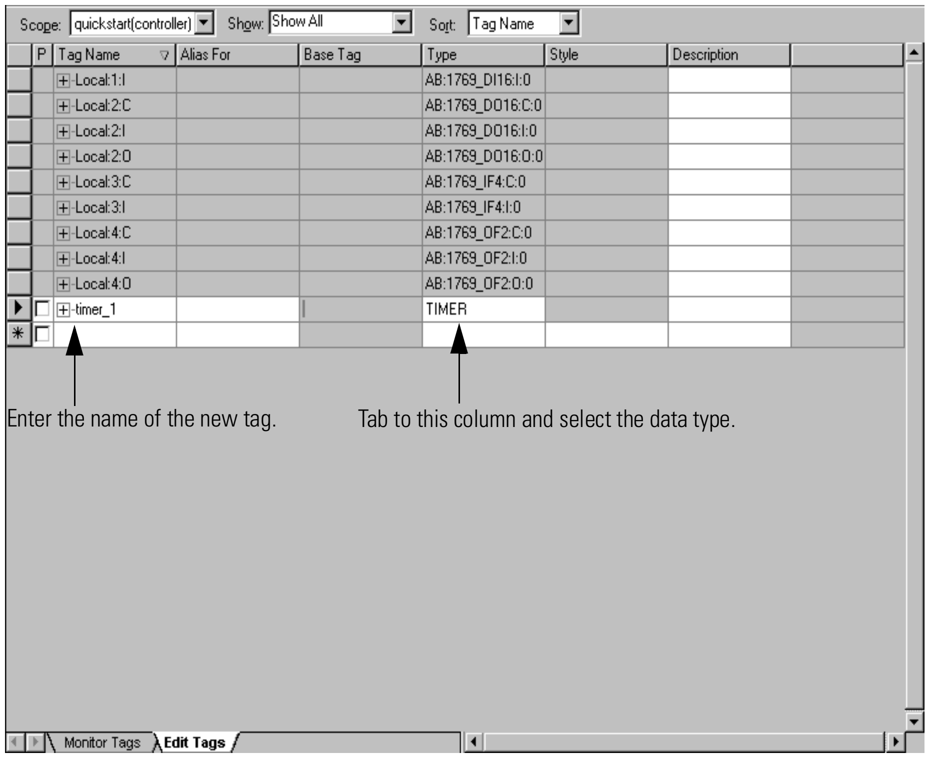
   The controller's response to a CompactBus connection failure is fixed to always fault the controller. It is not configurable.



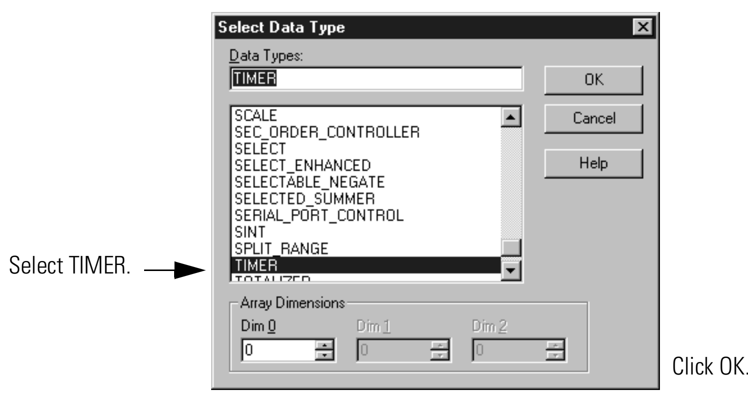
# Create Tags

## Creating Other Tags

1. Click on *Edit tags* to create a tag.

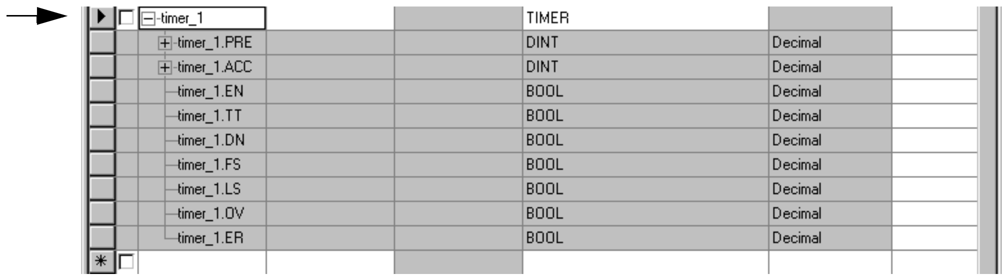



2. Select the data type.



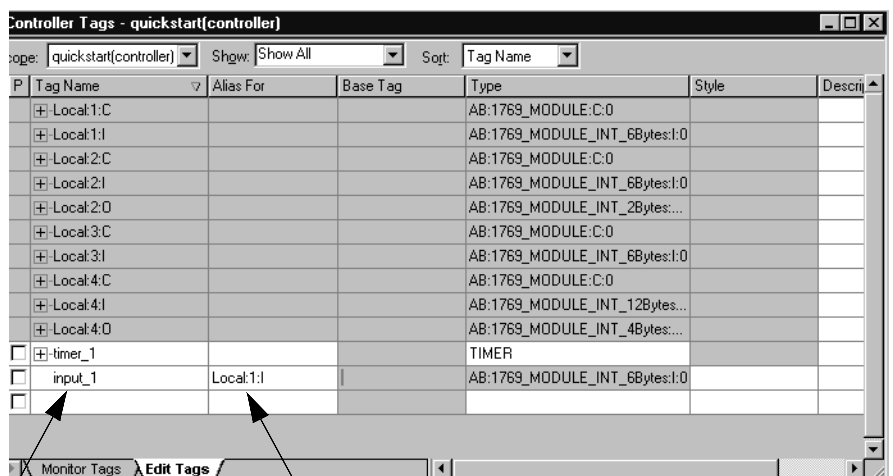
3. The software displays the tag.

   Click the + sign to display the members of the TIMER structure. You might have to resize the column to see the tag extensions.




## Documenting I/O with Alias Tags

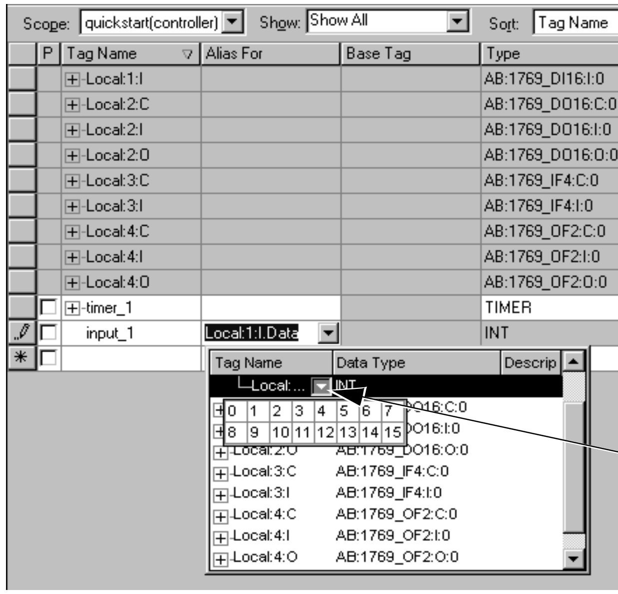
1. Create an alias tag *input_1* for Local:1:I.Data.1.




Enter the name of the tag.

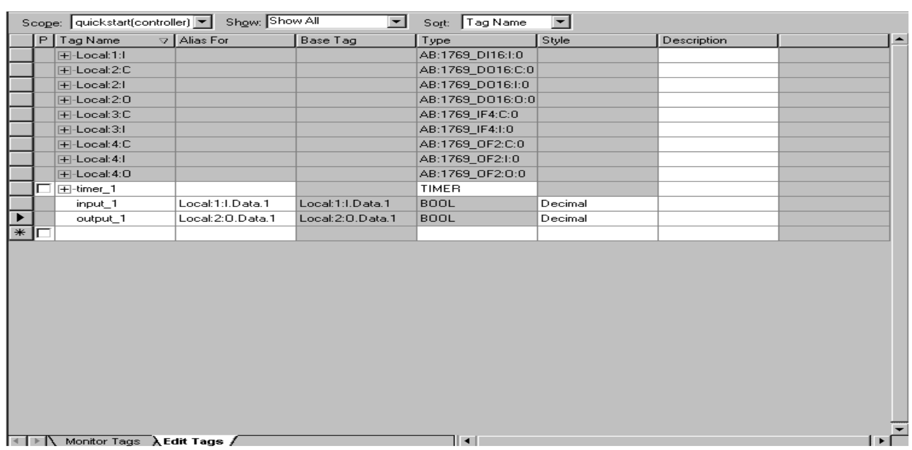
Tab here or click in the box. Click here to select a tag to reference.

2. Select an input data word.




Click here to display a grid of bits and select the input bit.

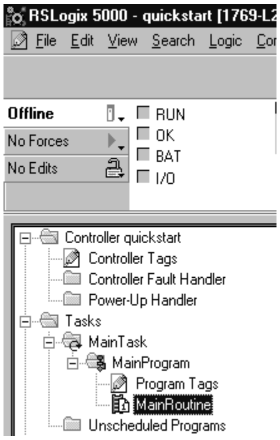
3. Repeat steps 1 and 2 above to create an alias tag *output_1* for Local:2:O.Data.1




## Improving Performance Based on Tag Type

When performing math operations such as adding and counting, use the DINT data type to maximize performance and minimize memory usage. See Appendix D, Execution Time, for details.

## Enter Logic

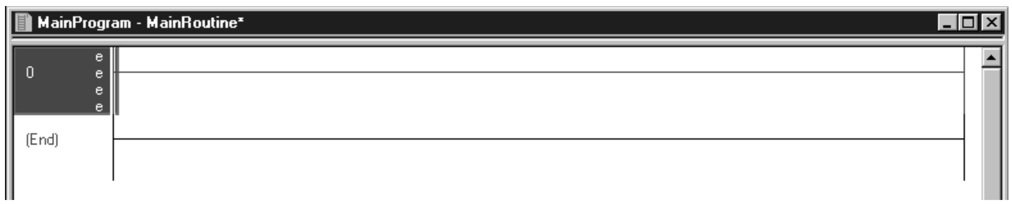



1. Use default task, program, and routine.

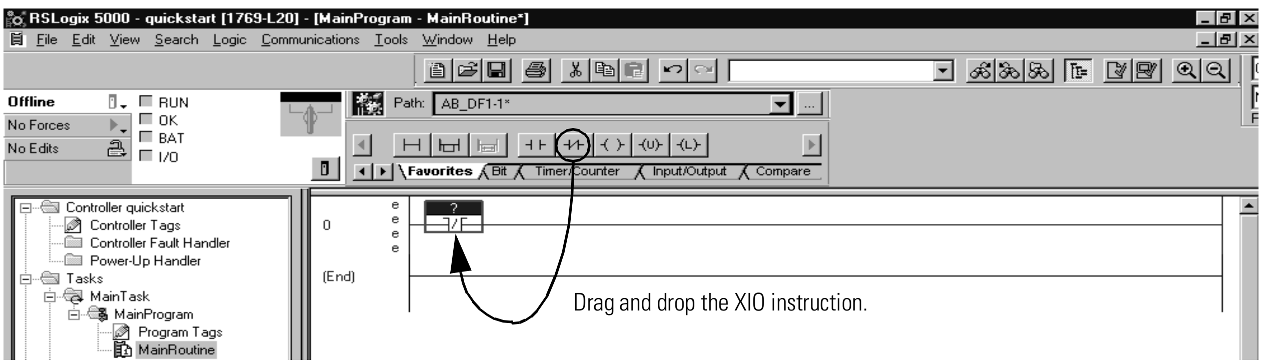
   When you created the project, the software automatically created a MainTask, MainProgram, and MainRoutine. Use these defaults for this example.

   Double-click MainRoutine.

   The software displays an empty routine.

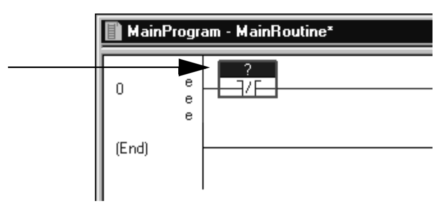



2. Enter an XIO instruction.

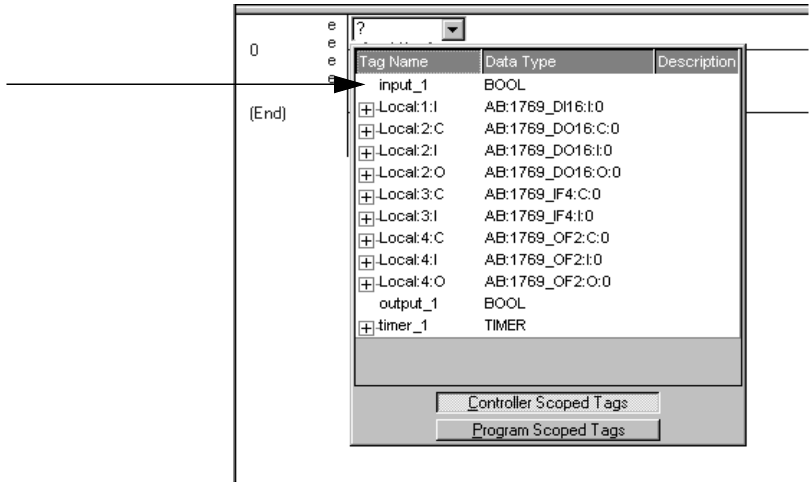



3. Assign a tag to the XIO instruction.

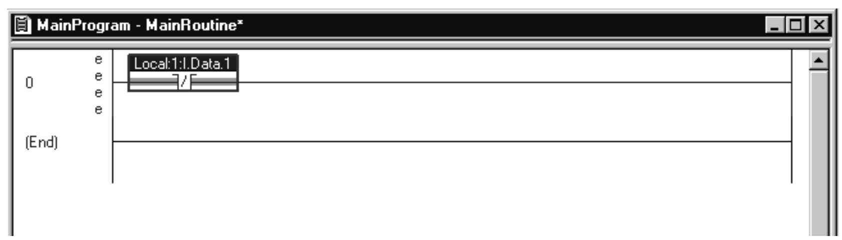
   a. Double-click the tag area of the instruction.



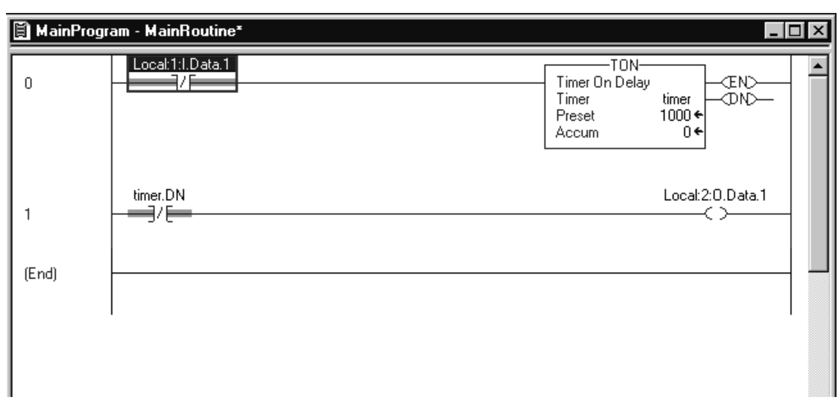
b. Use the drop-down menu to select input_1 by double-clicking on it.




The software displays an incomplete rung.




4. Enter this logic.

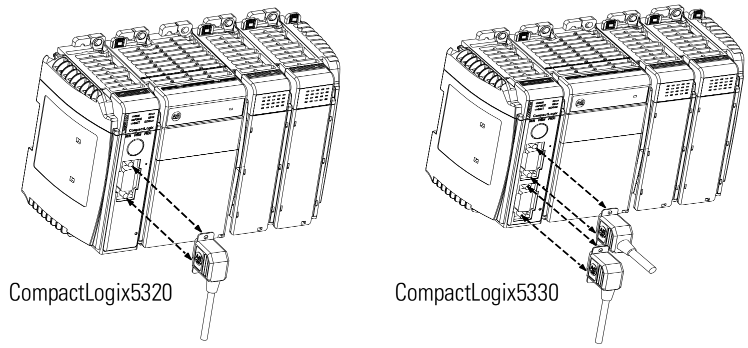



5. To save the project, select Save from the File menu.

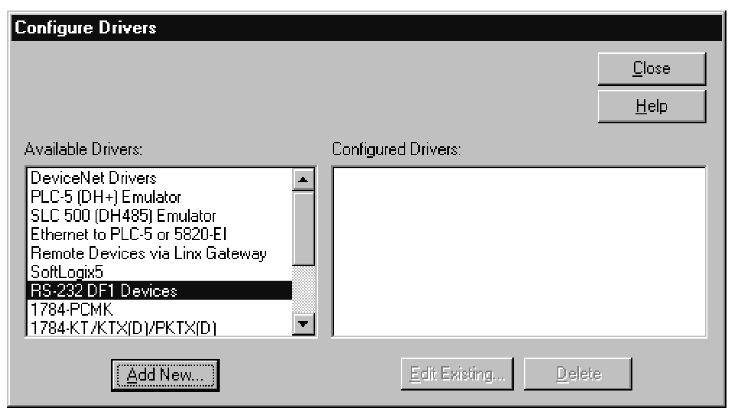
## Download a Project

1. Make a serial connection from the workstation to the controller.

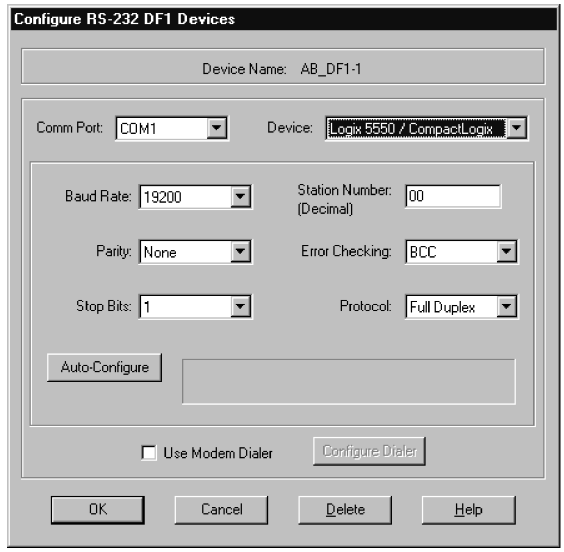
   To connect two cables to the CompactLogix5330, turn the upper cable around so that the straight connector attaches to the controller.




2. Configure an RSLinx communication driver:
   a. In RSLinx software, select Communication → Configure Drivers.
   b. From the Available Driver Types list, select “RS-232 DF1 Devices” and click Add New.
   c. Choose a name for the driver and click OK.



d. Select the “Logix5550/CompactLogix” from the Device pull-down menu, and specify the COM port on your PC. Click Auto-Configure to have the software determine the remaining serial settings.




**TIP**

The default value for Error Checking is BCC. The PLC-5 and most peripherals usually use BCC error checking. Most SLC 500 based products use CRC.

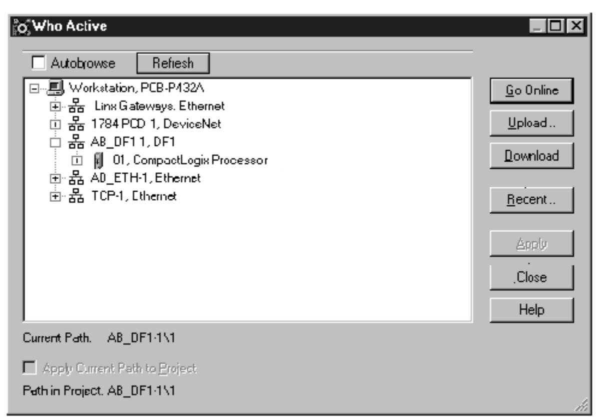
**3.** Download the project from the Communications menu.

a. Be sure the controller is in the Program mode.

b. In RSLogix5000 software, select Communication → Who Active.

c. Expand the DF1 network and select your controller.

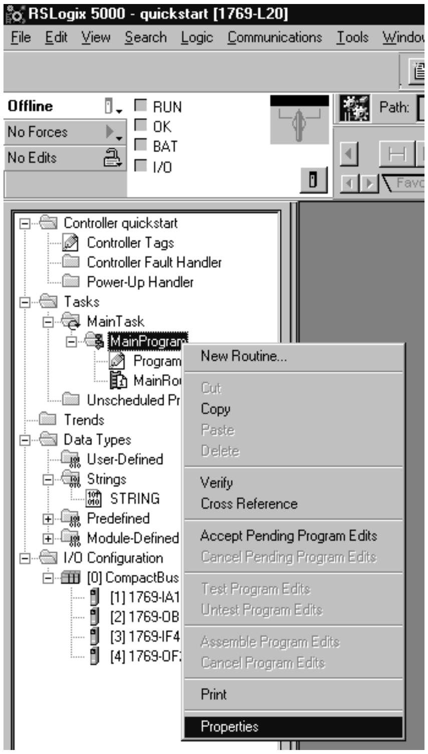
d. Click Download. Confirm the download when prompted.




**4.** Place the controller in Remote Run mode.

## View Status

### Viewing Program Scan Time



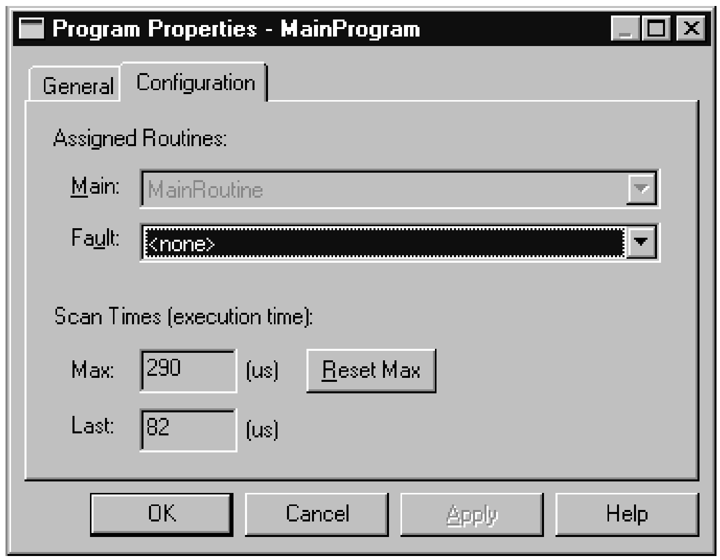

1. View properties for the MainProgram.

   a. Place the cursor over the MainProgram folder.

   b. Click the right mouse button and select Properties.

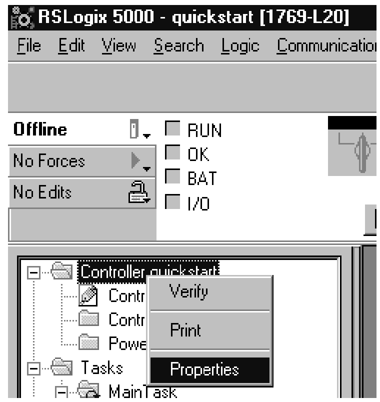
2. Select the Configuration tab.

   The configuration tab displays the maximum and last scan times for the program.



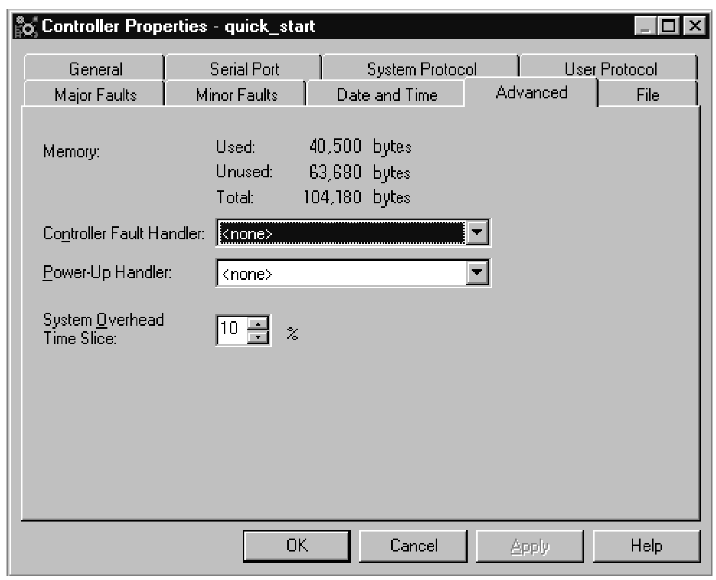
## Viewing Controller Memory Usage

1. View properties for *Controller quickstart* by placing the cursor over the Controller quickstart folder, clicking the right mouse button and selecting Properties.




2. Select the Advanced tab.

In addition to other information, the Advanced tab displays controller memory usage.




**IMPORTANT** The amount of memory that the software displays includes both the user-available memory and the memory reserved for overhead. Certain operations dynamically allocate and re-allocate user-available memory. See the specifications for your controller and Appendix E, Dynamic Memory Allocation in CompactLogix Controllers, to estimate how much memory you have available for programming.

## What To Do Next

Once your controller is installed and operating, you can use RSLogix 5000 programming software to develop and test your control application.

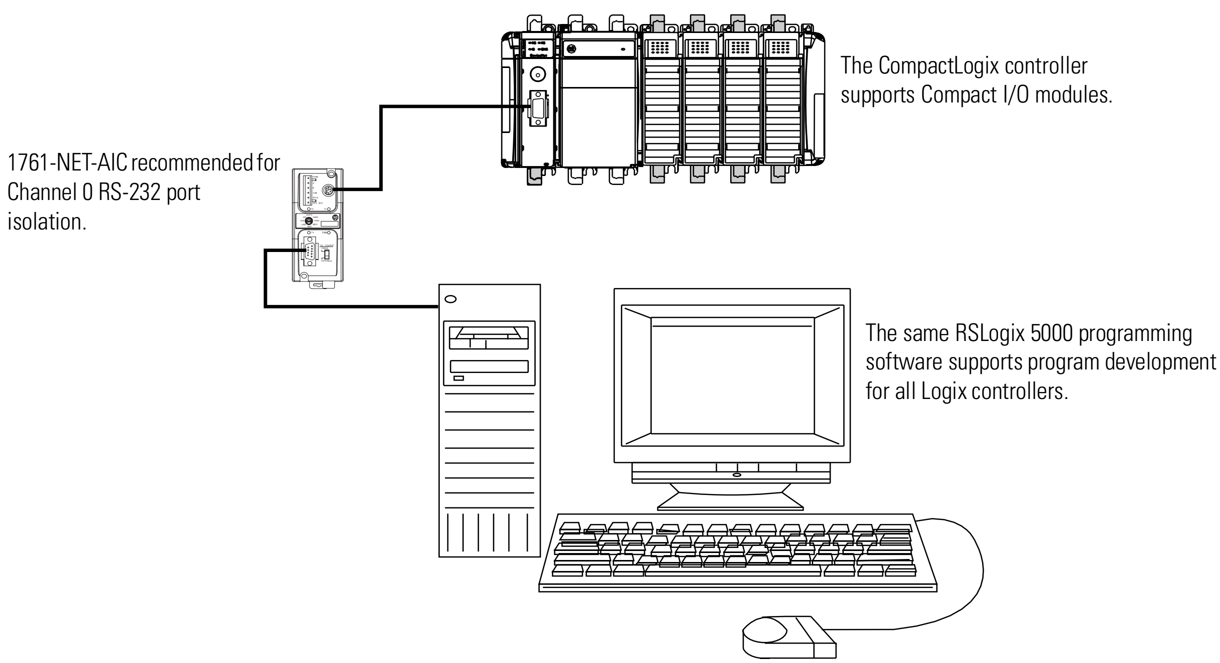
Use the remaining chapters in this manual as reference material for how the CompactLogix controller operates in the Logix environment.

# What Is CompactLogix?

## Using This Chapter

The CompactLogix controller, part of the Logix family of controllers, provides a small, cost-effective system built on these components:

- CompactLogix controller that supports the Logix instruction set.
- RSLogix 5000 programming software that supports every Logix controller.
- Compact I/O modules that provide a compact, DIN-rail or panel-mounted I/O system.
- Serial port that supports multiple communication protocols. CompactLogix5320 has one serial port.  CompactLogix5330 has two. Channel 1 on CompactLogix5330 is isolated.
- Communication interface modules provide peer-to-peer communication and program upload/download over DH-485, DeviceNet, or Ethernet.

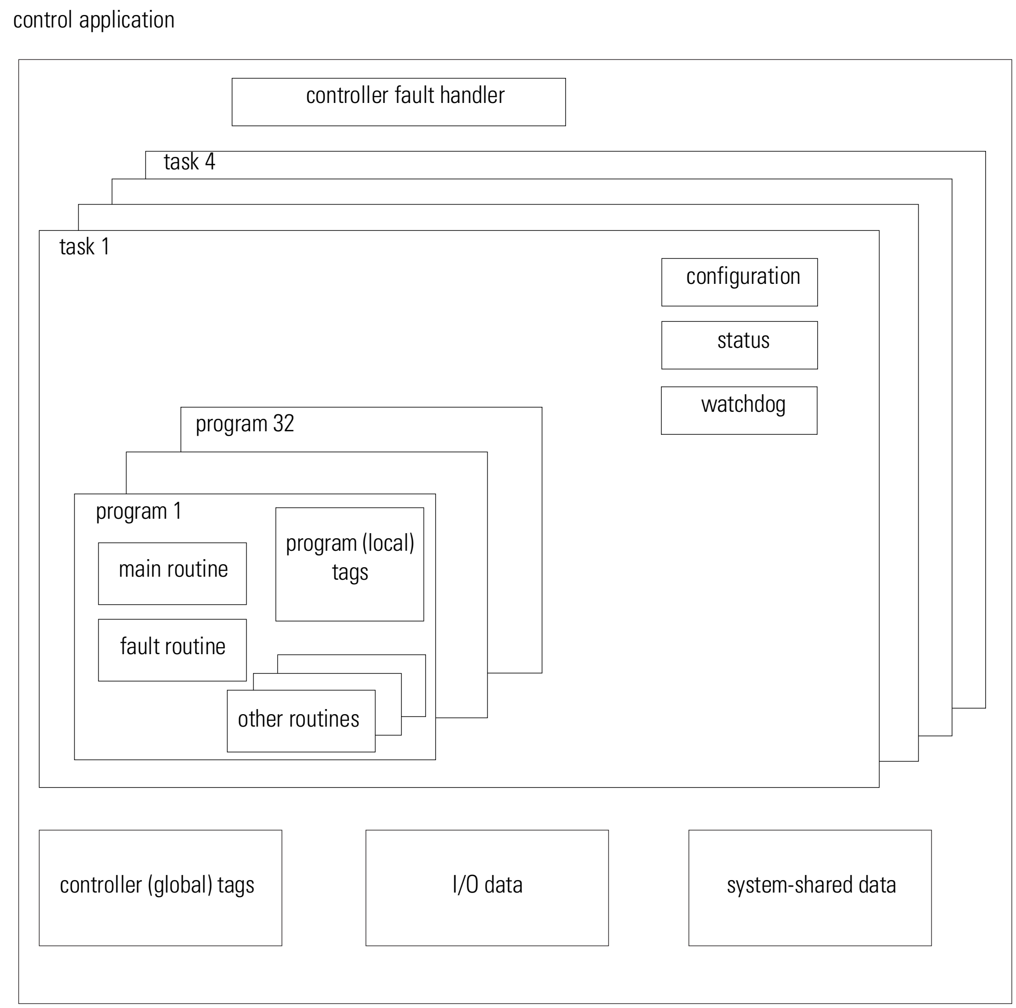



| For information about: | See page |
|---|---|
| developing programs | 2-2 |
| direct connections for I/O modules | 2-6 |
| selecting a system overhead percentage | 2-6 |

## Developing Programs

The controller operating system is a preemptive multitasking system that is IEC 1131-3 compliant. This environment provides:

- tasks to configure controller execution
- programs to group data and logic
- routines to encapsulate executable code written in a single programming language



## Defining Tasks

A task provides scheduling and priority information for a set of one or more programs. You can configure tasks as either continuous or periodic. The CompactLogix controller supports as many as 4 tasks, only one of which can be continuous.

A task can have as many as 32 separate programs, each with its own executable routines and program-scoped tags. Once a task is triggered (activated), all the programs assigned to the task execute in the order in which they are grouped. Programs can only appear once in the Controller Organizer and cannot be shared by multiple tasks.

### *Specifying Task Priorities*

Each task in the controller has a priority level. The operating system uses the priority level to determine which task to execute when multiple tasks are triggered. You can configure periodic tasks to execute from the lowest priority of 15 up to the highest priority of 1. A higher priority task will interrupt any lower priority task. The continuous task has the lowest priority and is always interrupted by a periodic task.

The CompactLogix controller uses a dedicated periodic task at priority 7 to process I/O data. This periodic task executes every 2 ms. Its total execution time is as long as it takes to scan the configured I/O modules. See Calculating I/O Scan Times on page D-17 for information on estimating the I/O scan time.

How you configure your tasks affects how the controller receives I/O data. Tasks at priorities 1 to 6 take precedence over the dedicated I/O task. Tasks in this priority range can impact I/O processing time. A task of priority 1 to 6 that requires 1/2 ms to execute and is scheduled to run every millisecond, consumes 1 ms of CPU time. This leaves the dedicated I/O task 1 ms to complete its job of scanning the configured I/O. However, if you were to schedule two high priority tasks (1 to 6) to run every millisecond, and they both required 1/2 ms or more to execute, no CPU time would be left for the dedicated I/O task . Furthermore, if you have so much configured I/O that the execution time of the dedicated I/O task approaches 2 ms (or the combination

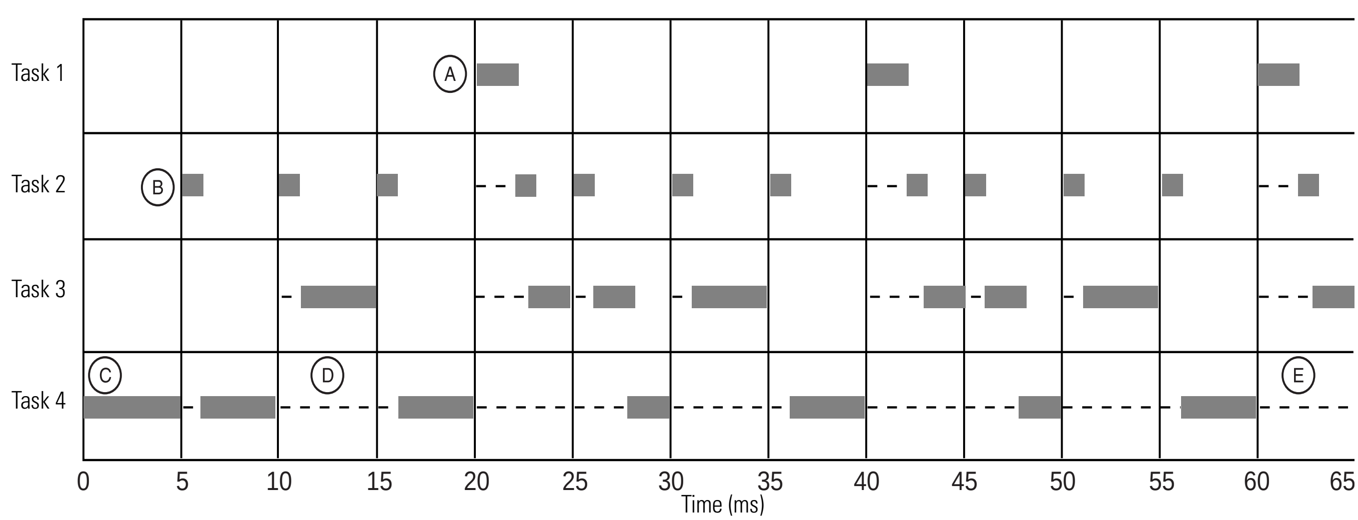
of the high priority tasks and the dedicated I/O task approaches 2 ms) no CPU time is left for low priority tasks (8 to 15).

**TIP**

For example, if your program needs to react to inputs and control outputs at a deterministic rate, configure a periodic task with a priority higher than 7 (1 through 6). This keeps the dedicated I/O task from affecting the periodic rate of your program. However, if your program contains a lot of math and data manipulation, place this logic in a task with priority lower than 7 (8 through 15), such as the continuous task, so that the dedicated I/O task is not adversely affected by your program.

The following example shows the task execution order for an application with periodic tasks and a continuous task.

| Task: | Priority Level: | Task Type: | Example Execution Time: | Worst Case Completion Time: |
|---|---|---|---|---|
| 1 | 5 | 20 ms periodic task | 2 ms | 2 ms |
| 2 | 7 | dedicated I/O task<br>2 ms fixed RPI | 1 ms | 3 ms |
| 3 | 10 | 10 ms periodic task | 4 ms | 8 ms |
| 4 | none (lowest) | continuous task | 25 ms | 60 ms |



**Notes:**

**A.** The highest priority task interrupts all lower priority tasks.

**B.** The dedicated I/O task can be interrupted by tasks with priority levels 1 to 6. The dedicated I/O task interrupts tasks with priority levels 8 to 15. This task runs at the fixed RPI rate scheduled for the CompactLogix system (2ms in this example).

**C.** The continuous task runs at the lowest priority and is interrupted by all other tasks.

**D.** A lower priority task can be interrupted multiple times by a higher priority task.

**E.** When the continuous task completes a full scan it restarts immediately, unless a higher priority task is running.

## Defining Programs

Each program contains program tags, a main executable routine, other routines, and an optional fault routine. Each task can schedule as many as 32 programs.

The scheduled programs within a task execute to completion from first to last. Programs that are not attached to any task show up as unscheduled programs. You must specify (schedule) a program within a task before the controller can scan the program.

## Defining Routines

A routine is a set of logic instructions in a single programming language, such as ladder logic. Routines provide the executable code for the project in a controller. A routine is similar to a program file or subroutine in a PLC or SLC controller.

Each program has a main routine. This is the first routine to execute when the controller triggers the associated task and calls the associated program. Use logic, such as the Jump to Subroutine (JSR) instruction, to call other routines.

You can also specify an optional program fault routine. The controller executes this routine if it encounters an instruction-execution fault within any of the routines in the associated program.

## Direct Connections for I/O Modules

The CompactLogix system uses direct connections to transmit I/O data. Each local I/O module utilizes a direct connection to the CompactLogix controller. A direct connection is a real-time, data transfer link between the controller and an I/O module. The controller maintains and monitors the connection between the controller and the I/O module. Any break in the connection, such as a module fault, causes the controller to set fault status bits in the input data area associated with the module.

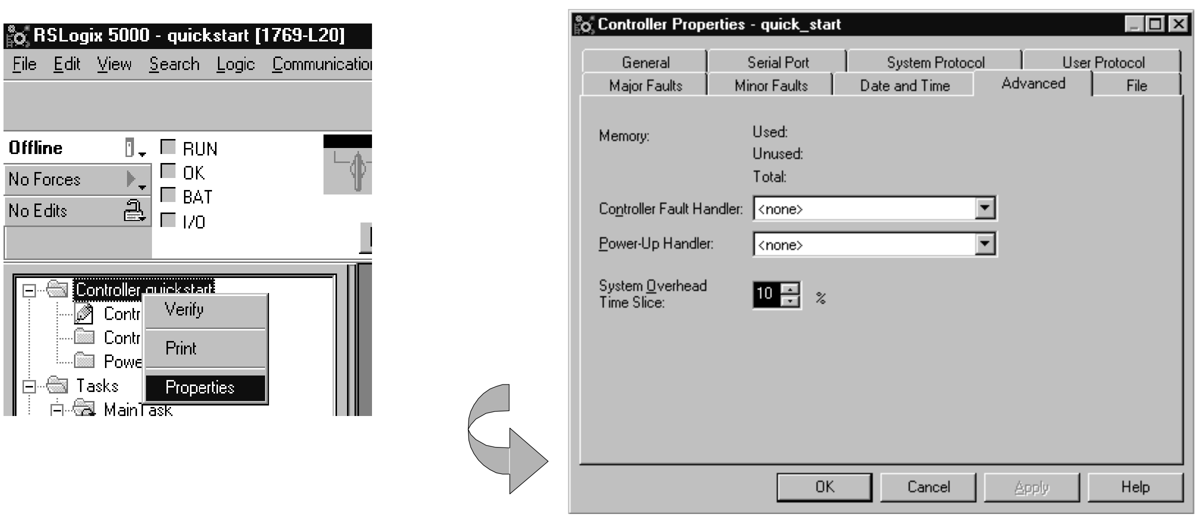
**ATTENTION**

CompactLogix does not support Removal and Insertion Under Power (RIUP). While the CompactLogix system is under power, any break in the connection between the power supply and the processor (i.e. removing the power supply, processor, or an I/O module) will clear processor memory (including the user program).

## Selecting a System Overhead Percentage

The Controller Properties dialog lets you specify a percentage for system overhead. This percentage specifies the percentage of controller time (excluding the time for periodic tasks) that is devoted to communication and background functions.

1. View properties for the controller and select the Advanced tab.




System overhead functions include:

- communicating with programming and HMI devices (such as RSLogix 5000 software)
- responding to messages
- sending messages, including block-transfers

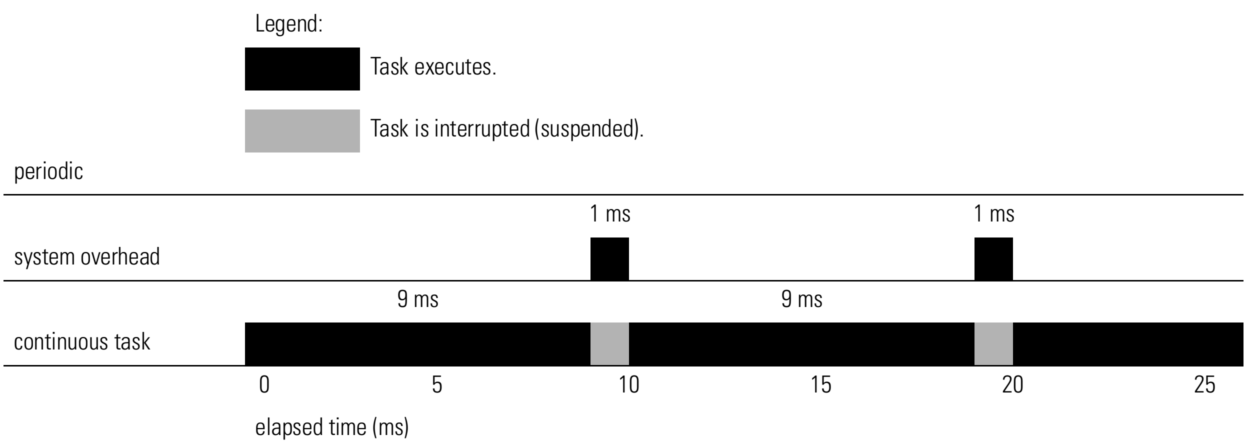
The controller performs system overhead functions for up to 1 ms at a time. If the controller completes the overhead functions in less than 1 ms, it resumes the continuous task.

If communications are not completing fast enough, increase the system overhead percentage. As you increase the system overhead percentage, the overall program scan also increases.

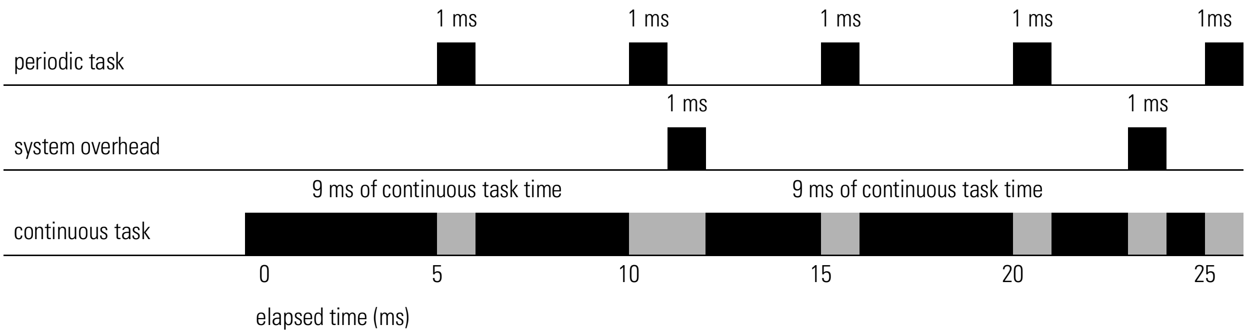
The following table shows the ratio between the continuous task and the system overhead functions:

| At this time slice: | The continuous tasks runs for: | And then overhead occurs for up to: |
|---|---|---|
| 10% | 9 ms | 1 ms |
| 20% | 4 ms | 1 ms |
| 33% | 2 ms | 1 ms |
| 50% | 1 ms | 1 ms |

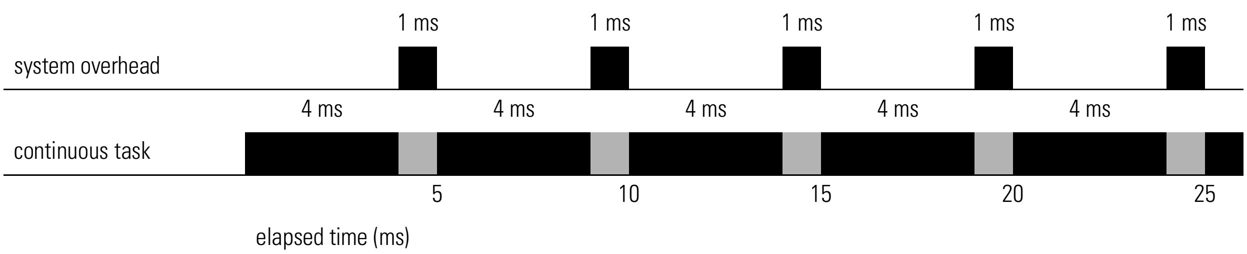
At the default time slice of 10%, system overhead interrupts the continuous task every 9 ms (of continuous task time), as illustrated below.



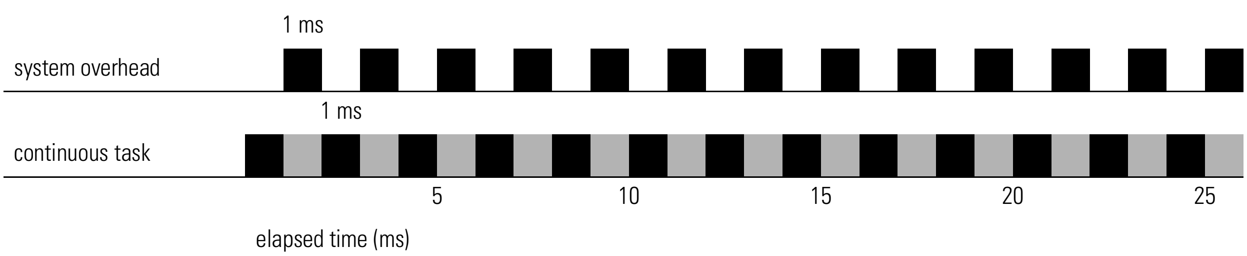
The interruption of a periodic task increases the elapsed time (clock time) between the execution of system overhead, as shown below.



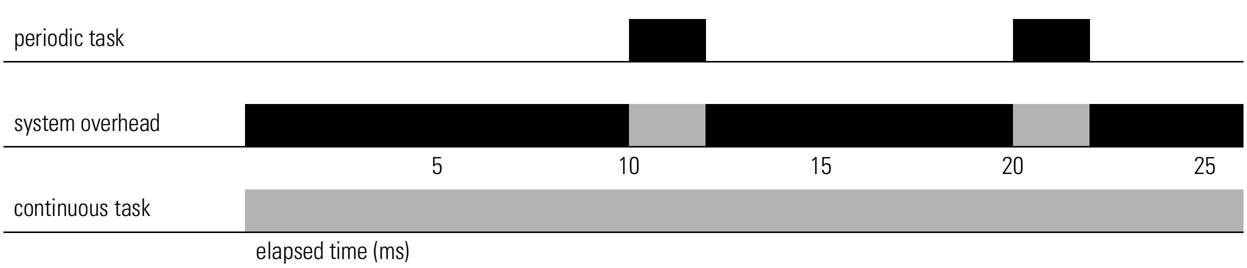

If you increase the time slice to 20%, the system overhead interrupts the continuous task every 4 ms (of continuous task time).




If you increase the time slice to 50%, the system overhead interrupts the continuous task every 1 ms (of continuous task time).




If the controller only contains a periodic task(s), the system overhead timeslice value has no effect. System overhead runs whenever a periodic task is not running.



# Placing, Configuring, and Monitoring Local I/O

## Using This Chapter



## Placing Local I/O Modules

### I/O Configuration Rules

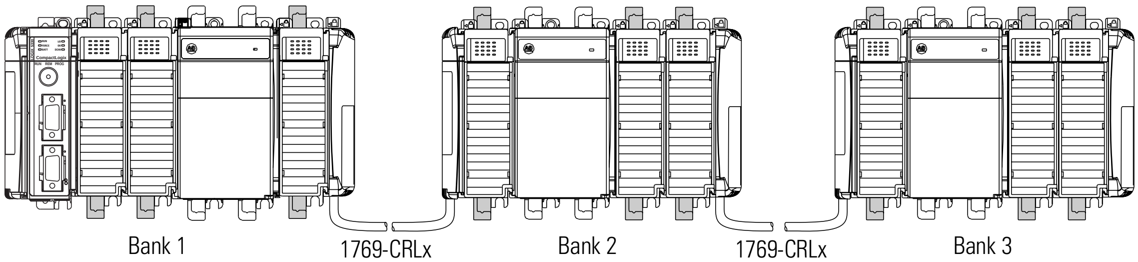
The CompactLogix5320 controller supports as many as 8 local I/O modules on the CompactBus. The CompactLogix5330 controller supports up to 16 local I/O modules.

You can also use the 1769-CRR1/-CRR3 or 1769-CRL1/-CRL3 cable to split the system into banks of I/O modules. You can split a bank right after the power supply or after any I/O module. Each bank must contain one power supply.  An end cap/terminator must be used on the last I/O bank. CompactLogix5320 supports a maximum of two banks.  CompactLogix5330 supports a maximum of three banks.

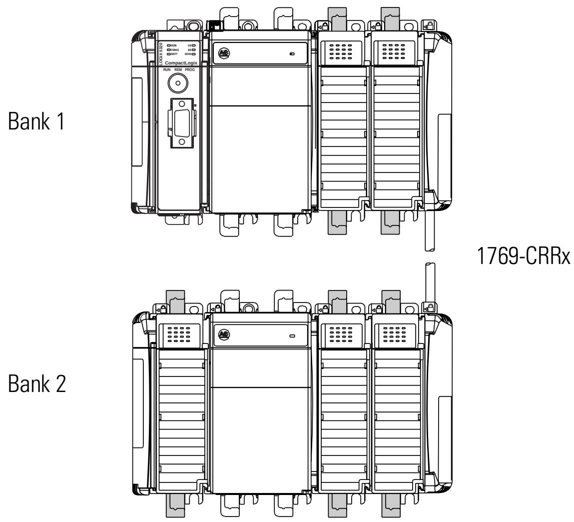
The first bank includes the CompactLogix controller in the far left position.  The controller must be located within 4 positions of the bank's power supply. Only one controller may be used in a CompactLogix system.

Each I/O module also has a power supply distance rating (the number of modules from the power supply). Each module must be located within its distance rating.

**Horizontal Orientation**




**Vertical Orientation**




**ATTENTION**

CompactLogix does not support Removal and Insertion Under Power (RIUP). While the CompactLogix system is under power, any break in the connection between the power supply and the processor (i.e. removing the power supply, processor, or an I/O module) will clear processor memory (including the user program).

**IMPORTANT**

While under power, the removal of an end cap or a module (without breaking the connection between the processor and power supply) will fault the controller.

If the controller was in Program mode, cycle power in order to go to run successfully.

If the controller was in Run mode, cycle power. When the I/O LED is on (green, steady) and the OK LED is flashing red, turn the keyswitch from Program to Run and back to Program. When the OK LED turns on (green, steady), turn the keyswitch to Run.

## System Power Budget Calculation and Considerations

To validate your system, the total 5V dc current and 24V dc current consumed must be considered. The I/O modules must be distributed such that the current consumed from the left or right side of the power supply never exceeds 2.0A at 5V dc and 1.0A at 24V dc.

Use the following worksheet as a general guide to account for the amount of 5V dc and 24V dc current consumed by each band of I/O in your system. Be sure to follow the I/O configuration rules on page 3-1 when planning your system.

| Catalog Number | Number of Modules | Module Current Requirements | | Calculated Current = (Number of Modules) x (Module Current Requirements) | |
|---|---|---|---|---|---|
| | | at 5V dc (in mA) | at 24V dc (in mA) | at 5V dc (in mA) | at 24V dc (in mA) |
| 1769-L20 | | 600 | 0 | | |
| 1769-L30 | | 800 | 0 | | |
| 1769-IA16 | | 115 | 0 | | |
| 1769-IA8I | | 90 | 0 | | |
| 1769-IM12 | | 100 | 0 | | |
| 1769-IQ16 | | 115 | 0 | | |
| 1769-IQ6XOW4 | | 105 | 50 | | |
| 1769-OA8 | | 145 | 0 | | |
| 1769-OB16 | | 200 | 0 | | |
| 1769-OB16P | | 180 | 0 | | |
| 1769-OV16 | | 200 | 0 | | |
| 1769-OW8 | | 125 | 100 | | |
| 1769-OW8I | | 125 | 100 | | |
| 1769-IF4 (A) | | 120 | 150 | | |
| 1769-IF4 (B) | | 120 | 60 | | |
| 1769-OF2 (A) | | 120 | 200 | | |
| 1769-OF2 (B) | | 120 | 120 | | |
| 1769-IT6 | | 100 | 40 | | |
| 1769-IR6 | | 100 | 45 | | |
| 1769-ECR(1) | | 5 | 0 | | |
| 1769-ECL(1) | | 5 | 0 | | |
| **Total Modules:** | | **Total Current Required(2):** | | | |

(1) One 1769-ECR or 1769-ECL end cap/terminator is required in the system. The end cap/terminator used is dependent on your configuation.
(2) This number must not exceed the Power Supply Current Capacity listed below.

*Power Supply Current Capacity*

| Specification | 1769-PA2 | 1769-PB2 | 1769-PA4 | 1769-PB4 |
|---|---|---|---|---|
| Output Bus Current Capacity (0°C to +55°C) | 2A at 5V dc and 0.8A at 24V dc | | 4A at 5V dc and 2A at 24V dc | |
| 24V dc User Power Capacity (0°C to +55°C) | 250 mA (maximum) | not applicable | | |

## Determining When the Controller Updates I/O

The controller continually scans the control logic. One scan is the time it takes the controller to execute the logic once. Input data transfers to the controller and output data transfers to output modules are asynchronous to the logic scan.

**TIP**

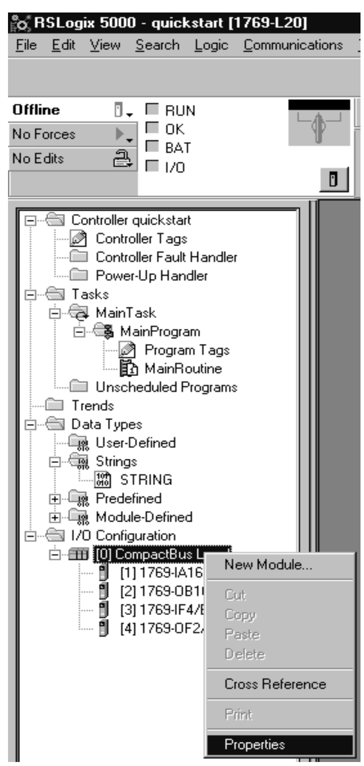
If you need to synchronize I/O to the logic scan, you can use the Synchronous Copy instruction (CPS) to buffer the I/O data.

Refer to the *Logix5000 Controllers Common Procedures Programming Manual*, publication number 1756-PM001B-EN-P for examples of I/O buffering or to the *Logix5000 Controllers General Instruction Set Reference Manual,* publication number 1756-RM003C-EN-P for information on the CPS instruction.

## Configuring the CompactBus

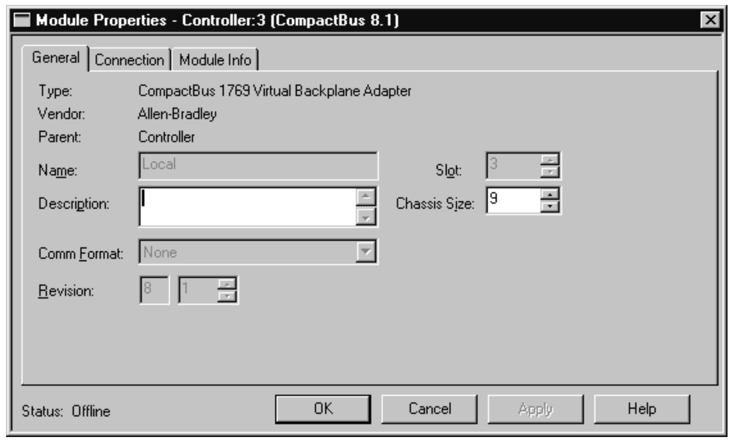
When you create a CompactLogix project, the programming software automatically creates the local CompactBus. You must configure the CompactBus.

To access the CompactBus properties screens, select the local CompactBus from the Controller Organizer. Right-click and select Properties.



## Specifying General Properties

On the General tab, specify the size of the Chassis. Enter the number of modules you plan to install. Include the CompactLogix controller in this total, along with a maximum of 8 (CompactLogix5320) or 16 (CompactLogix5330) I/O modules, not including the power supply.




**TIP**

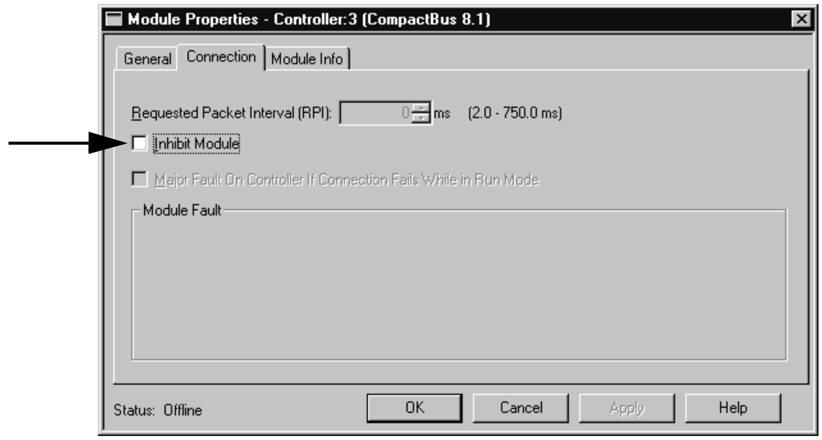
The Comm Format for the CompactBus is automatically set to None and cannot be changed because the controller uses direct connections to each I/O module.

## Inhibiting the CompactBus

Using the Connection tab, you can choose to inhibit or uninhibit the CompactBus.

**TIP**

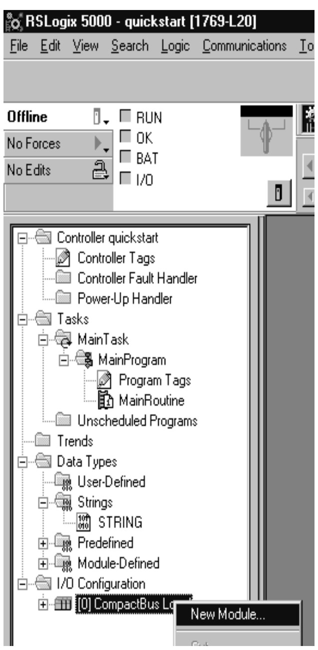
By inhibiting and then uninhibiting the CompactBus, you can write new configuration data to all modules in the system at once.




**IMPORTANT** The controller's response to a CompactBus connection failure is fixed to always fault the controller. It is not configurable.

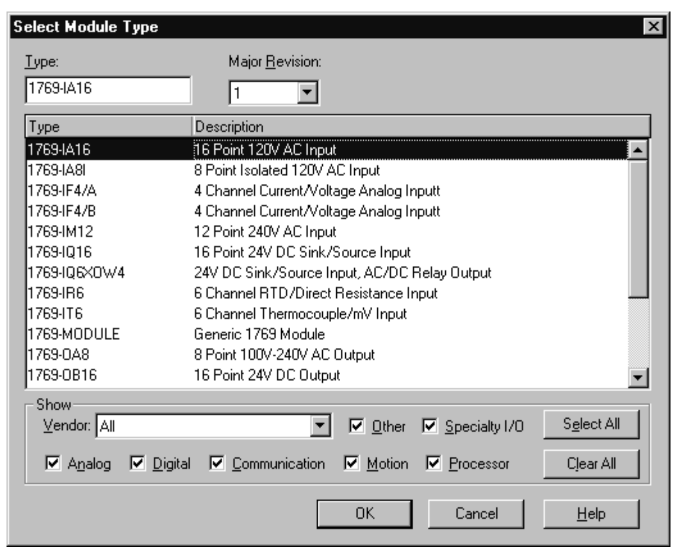
## Configuring Local I/O Modules

Use your programming software to configure the I/O modules for the controller. All the I/O modules on the CompactBus operate at a fixed RPI of 2 ms.



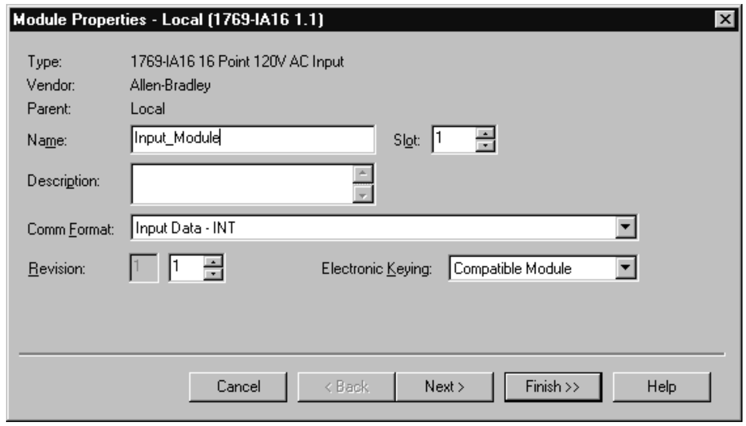

To configure an I/O module, right-click on the local CompactBus in the Controller Organizer and select New Module.

Select the 1769 module from the list of modules. For additional information and an example, see Appendix H, Configuring I/O with the 1769 Generic or Thin Profiles.




Click OK.

Enter a name and description (optional) for the module.




Click Next.

**TIP**

The above example shows the settings for 1769-IA16 in slot 1. The accessible fields change depending upon the type of module chosen. Discrete input modules are not configurable. For additional information and 1769 generic module application examples, see Appendix H, Configuring I/O with the 1769 Generic or Thin Profiles.

## Communication Formats

The communication format determines the data structure the I/O module uses. Each format supports a different data structure. Presently, the CompactLogix system supports two data formats:

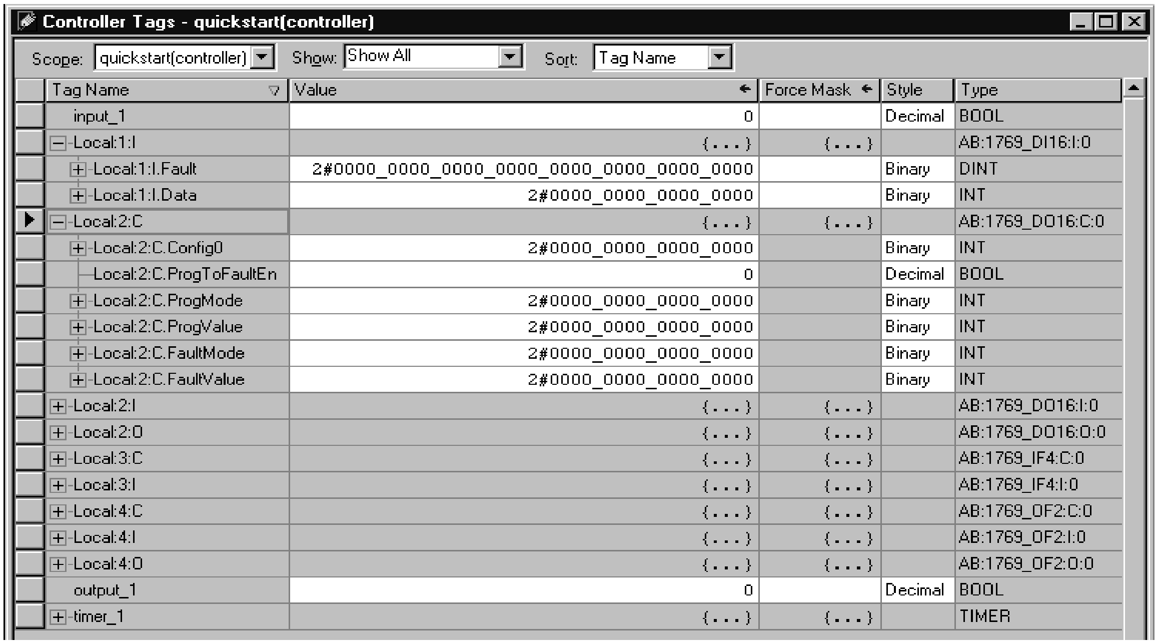
- Input Data – INT (for 1769 input modules)
- Data – INT (for 1769 output modules)

**TIP**

The CompactLogix controller must own its local I/O modules. No other Logix-based controller can own the local CompactLogix I/O.

The communication format determines the tag structure that is created for the module. Assume that a 1769-IA16 Input module is in slot 1.

The software creates the appropriate tags using the slot number to differentiate the tags for this example module from any other module.




| Tag Name | Value | Force Mask | Style | Type |
|---|---|---|---|---|
| input_1 | 0 | | Decimal | BOOL |
| -Local:1:I | {...} | {...} | | AB:1769_DI16:I:0 |
| +Local:1:I.Fault | 2#0000_0000_0000_0000_0000_0000_0000_0000 | | Binary | DINT |
| +Local:1:I.Data | 2#0000_0000_0000_0000 | | Binary | INT |
| -Local:2:C | {...} | {...} | | AB:1769_DO16:C:0 |
| +Local:2:C.Config0 | 2#0000_0000_0000_0000 | | Binary | INT |
| Local:2:C.ProgToFaultEn | 0 | | Decimal | BOOL |
| +Local:2:C.ProgMode | 2#0000_0000_0000_0000 | | Binary | INT |
| +Local:2:C.ProgValue | 2#0000_0000_0000_0000 | | Binary | INT |
| +Local:2:C.FaultMode | 2#0000_0000_0000_0000 | | Binary | INT |
| +Local:2:C.FaultValue | 2#0000_0000_0000_0000 | | Binary | INT |
| +Local:2:I | {...} | {...} | | AB:1769_DO16:I:0 |
| +Local:2:O | {...} | {...} | | AB:1769_DO16:O:0 |
| +Local:3:C | {...} | {...} | | AB:1769_IF4:C:0 |
| +Local:3:I | {...} | {...} | | AB:1769_IF4:I:0 |
| +Local:4:C | {...} | {...} | | AB:1769_OF2:C:0 |
| +Local:4:I | {...} | {...} | | AB:1769_OF2:I:0 |
| +Local:4:O | {...} | {...} | | AB:1769_OF2:O:0 |
| output_1 | 0 | | Decimal | BOOL |
| +timer_1 | {...} | {...} | | TIMER |

See Appendix H, Configuring I/O with the 1769 Generic or Thin Profiles, for details on the data structures created for I/O modules.

## Inhibiting I/O Module Operation

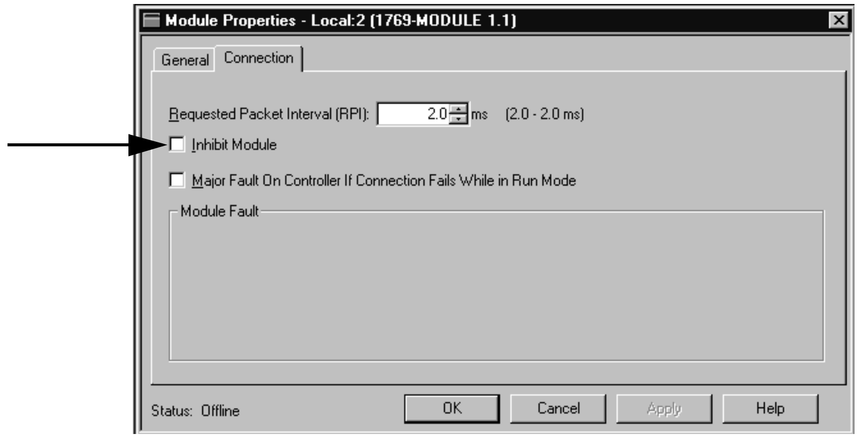
In some situations, such as when initially commissioning a system, it is useful to disable portions of a control system and enable them as you wire up the control system. The controller lets you inhibit individual modules or groups of modules, which prevents the controller from trying to communicate with these modules. Inhibiting a module shuts down the connection from the controller to that module.

When you create an I/O module, it defaults to being not inhibited. You can change an individual module's properties to inhibit a module.

**ATTENTION**

Inhibiting a module closes the connection to the module and prevents communication of I/O data.

On the Connection tab of the Module Properties dialog, you can select to inhibit that specific module.




**TIP**

To easily inhibit all local I/O modules, you can inhibit the CompactBus, which in turn inhibits all the modules on that bus. See Configuring the CompactBus on page 3-4.

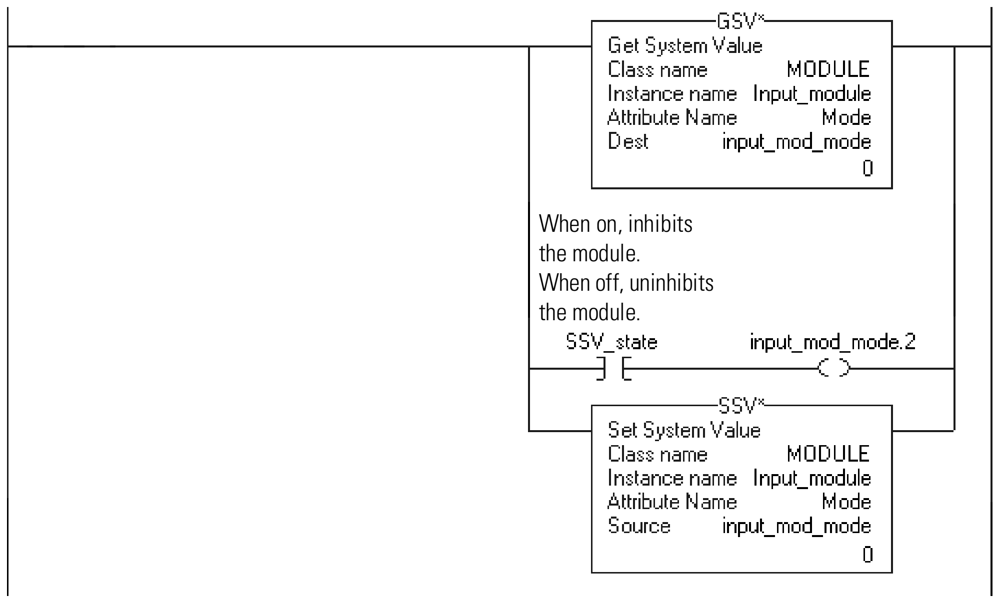
When you select to inhibit a module, the controller organizer displays a yellow attention symbol ⚠ over the module.

| If you are: | Inhibit a module to: |
|---|---|
| offline | put a place holder for a module you are configuring.<br><br>The inhibit status is stored in the project. When you download the project, the module is still inhibited. |
| online | stop communication to a module.<br><br>If you inhibit a module while you are connected to the module, the connection to the module is closed. The moduler's outputs turn off.<br><br>If you inhibit a module but a connection to the module was not established (perhaps due to an error condition or fault), the module is inhibited. The module status information changes to indicate that the module is inhibited and not faulted.<br><br>If you uninhibit a module (clear the check box), and no fault condition occurs, a connection is made to the module and the module is dynamically reconfigured with the configuration you created for that module.<br><br>If you uninhibit the module and a fault condition occurs, a connection is not made to the module. The module status information changes to indicate the fault condition. |

**TIP**

To inhibit a module from logic, you must first read the Mode attribute for the module using a GSV instruction. Set bit 2 to the inhibit status (1 to inhibit or 0 to uninhibit). Use a SSV instruction to write the Mode attribute back to the module. For example:

The GSV instruction gets the current status of the module named "input_module." The SSV instruction sets the state of "input_module" as either inhibited or uninhibited.

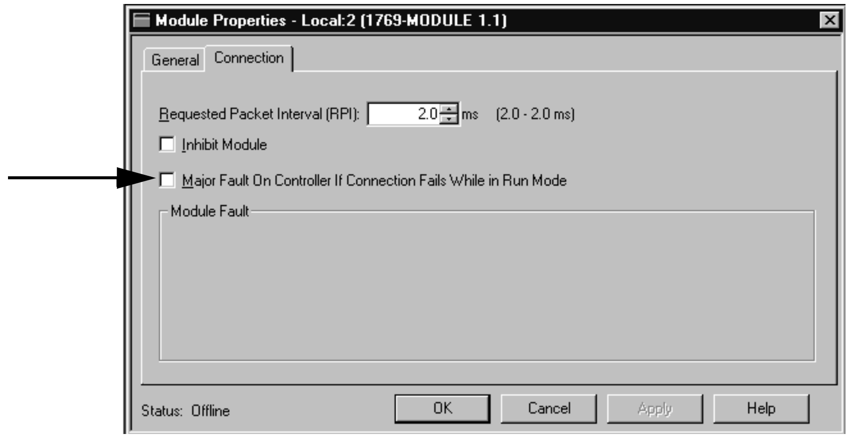



## Configuring the Module's Response to a Connection Failure

Using the Connection tab in the ControlLogix and FlexLogix systems, you can also configure modules to generate a major fault in the controller if they lose their connection with the controller. This feature, however, is not available in a CompactLogix system because the controller's response to a CompactBus connection failure is fixed to always fault the controller. The CompactBus setting supersedes the individual module's setting. See Inhibiting the CompactBus on page 3-5.

**IMPORTANT**

Although you can select and de-select the "Major Fault On Controller If Connection Fails While in Run Mode" option, this will not effect controller operation. The controller's response to a connection failure of any I/O module is fixed to always fault the controller.




## Accessing I/O Data

The programming software displays I/O data as structures of multiple tags that depend on the specific features of the I/O module. The names of the data structures are based on the location of the I/O module. The programming software automatically creates the necessary structures and tags when you configure the module. Each tag name follows this format:

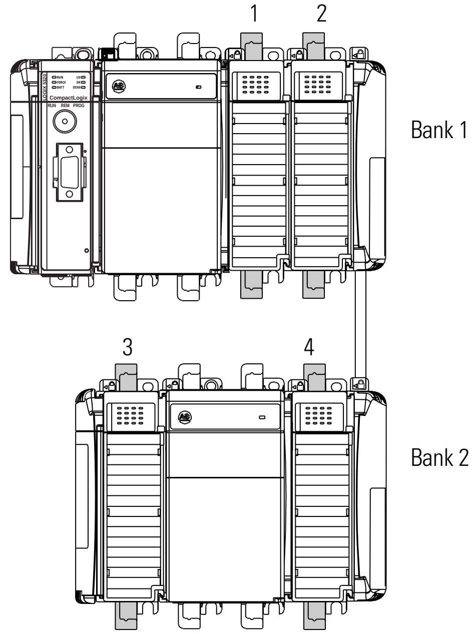
*Location:SlotNumber:Type.MemberName.SubMemberName.Bit*

where:

| This address variable: | Is: |
|---|---|
| Location | Identifies network location<br>LOCAL = local chassis |
| SlotNumber | Slot number of I/O module in its chassis |
| Type | Type of data<br>I = input<br>O = output<br>C = configuration |
| MemberName | Specific data from the I/O module; depends on the type of data the module can store<br><br>For example, Data and Fault are possible fields of data for an I/O module. Data is the common name for values that are sent to or received from I/O points. |
| SubMemberName | Specific data related to a MemberName. |
| Bit (optional) | Specific point on the I/O module; depends on the size of the I/O module (0-31 for a 32-point module) |

The following examples show addresses for data in a CompactLogix system.

**EXAMPLE** I/O module on the local CompactBus utilizing two banks




Sample tag names for this example:

| Location: | Example Tag Name: |
|---|---|
| input module in slot 1, LOCAL Bank 1 | Local:1:C<br>Local:1:I |
| output module in slot 2, LOCAL Bank 1 | Local:2:C<br>Local:2:I<br>Local:2:O |
| analog input module in slot 3, LOCAL Bank 2 | Local:3:C<br>Local:3:I |
| analog output module in slot 4, LOCAL Bank 2 | Local:4:C<br>Local:4:I<br>Local:4:O |

### Using Aliases to Simplify Tag Names

An alias lets you create a tag that represents another tag. This is useful for defining descriptive tag names for I/O values. For example:

| Example: | | Description: |
|---|---|---|
| I/O structure | Local:1:I:Data[0].0<br>Local:1:I:Fault.0 | The aliases describe the specific I/O points. |
| alias | light_on = Local:1:I:Data[0].0<br>light_off = Local:1:I:Fault.0 | |

## Monitoring I/O Modules

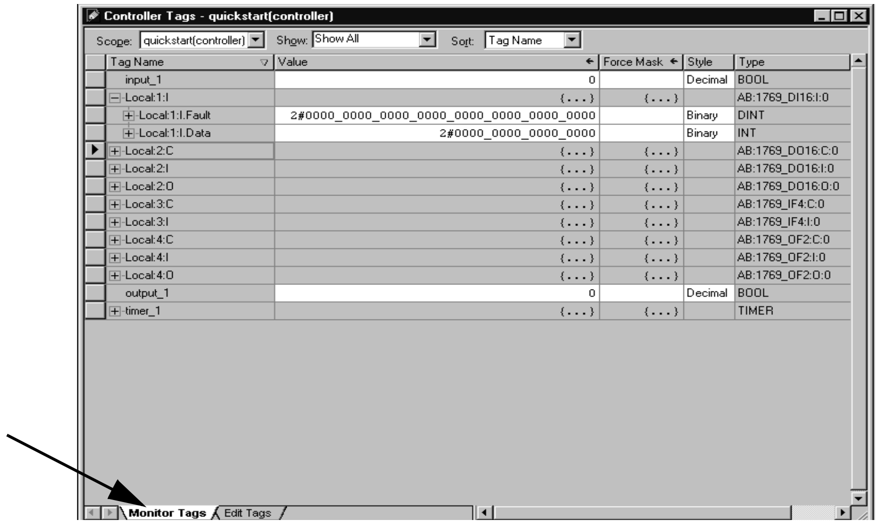
The CompactLogix controller offers different levels at which you can monitor I/O modules. You can:

- configure the module to fault if that module loses its connection to the controller (See Configuring the Module's Response to a Connection Failure on page 3-10).
- use the programming software to display fault data (See Displaying Fault Data on page 3-13)
- program logic to monitor fault data so you can take appropriate action (Refer to *Logix5000 Controllers Common Procedures Programming Manual*, publication number 1756-PM001B-EN-P, for examples.)

### Displaying Fault Data

Fault data for certain types of module faults can be viewed through the programming software.

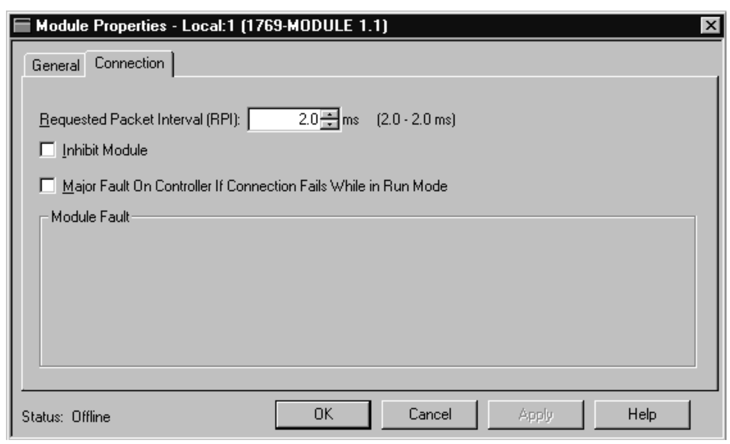
To view this data, select Controller Tags in the Controller Organizer. Right-click to select Monitor Tags.




If the module faults, but the connection to the controller remains open, the controller tags database displays the fault value 16#7000_0001. If the module is faulted and the connection to the controller is broken, the controller tags database displays a fault value of 16#FFFF_FFFF.

The display for the fault data defaults to decimal.  Change it to Hex to read the fault code.

You can also view module fault data on the Connection tab of the Module Properties screen.




See your 1769 module's user documentation for a description of module faults. To recover from module faults, correct the module fault condition and send new data to the module by downloading the user program with configuration data, inhibiting and then uninhibiting the module, or cycling power.

## End-Cap Detection and Module Faults

If a module that is not adjacent to an end cap experiences a fault and the connection to the controller is not broken, only the module enters the fault state.

If a module that is adjacent to an end cap experiences a fault, both the module and the controller transition to the fault state.

# Communicating with Devices on a Serial Link

## Using This Chapter



## Default Communication Configuration

The CompactLogix controllers have the following default communication configurations.

| Parameter | Channel 0 Default | Channel 1 Default (CompactLogix5330 only) |
|---|---|---|
| Baud Rate | 19.2K | 19.2K |
| Parity | none | none |
| Station Address | 0 | 0 |
| Control Lines | no handshaking | no handshaking |
| Error Detection | BCC | BCC |
| Embedded Responses | auto detect | auto detect |
| Duplicate Packet (Message) Detect | enabled | enabled |
| ACK Timeout | 50 counts | 50 counts |
| NAK Receive Limit | 3 retries | 3 retries |
| ENQ Transmit Limit | 3 retries | 3 retries |
| Data Bits | 8 | 8 |
| Stop Bits | 1 | 1 |
| Protocol | DF1 full-duplex | DF1 full-duplex |

**TIP**

Node Address is part of the default configuration. Changing the node address will result in the DCH0 LED turning off.

## System Protocol Options

The table below shows the system modes supported by Channels 0 and 1.

| Channel 0 | Channel 1 (CompactLogix5330 only) |
|---|---|
| DF1 full-duplex | DF1 full-duplex |
| DF1 master | DF1 half-duplex master |
| DF1 slave | DF1 half-duplex slave |
| DH-485 | DH-485 |
| ASCII | |

**TIP**

When using MSG instructions to send commands out the CompactLogix serial ports, Channel 0 is Port 2 and Channel 1 is Port 3. This information is required on the Path tab for the MSG instruction. See Appendix I, Messaging On DH-485 with SLC 5/03, CompactLogix5320 and CompactLogix5330 Controllers for more information.

## Using the Channel 0 Default Communication Push Button

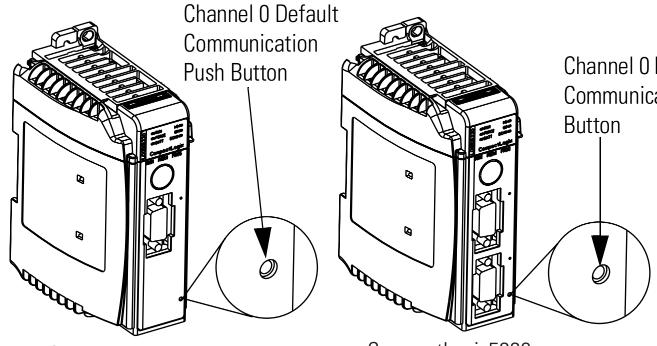
Use the Channel 0 Default Communication Push Button to change from the user-defined communication configuration to the default communications configuration. *Hold the button* until the Channel 0 Default Communications (DCH0) LED turns on (green, steady) showing that the default communication configuration is active.

**TIP**

Before pressing the Default Communication Push Button, be sure to note the present communication configuration for Channel 0. Pushing the Default Communication Push Button resets all configured parameters back to their default settings. To return the channel to its user-configured parameters, you must enter them manually while online with the controller or download them as part of a Logix Project file.

To accomplish this online, enter the Controller Properties screen under the Serial Port, System Protocol and User Protocol tabs.

The Channel 0 Default Communication Push Button is located on the front of the controller in the lower right corner.




**TIP**

The Default Communication Push Button is recessed.

## Configuring Your System for a Serial Link

For the CompactLogix controller to operate on a serial network, you need:

- a workstation with a serial port
- RSLinx software to configure the serial communication driver
- RSLogix5000 programming software to configure the serial port of the controller

**IMPORTANT**

Limit the length of serial (RS-232) cables to 15.2m (50 ft.).

## Step 1: Configure the Hardware

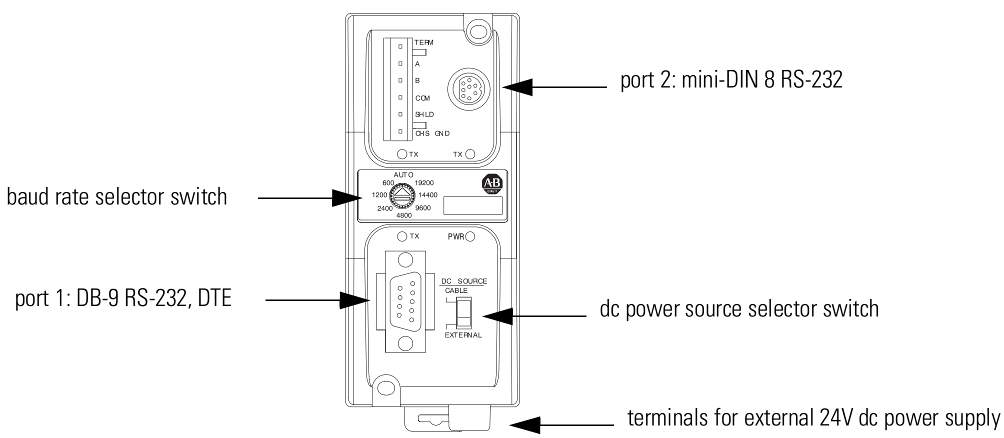
The Channel 0 RS-232 port on the CompactLogix5320 controller is a non-isolated serial port built-in to the front of the controller. The Channel 1 RS-232 port on the CompactLogix 5330 controller is isolated.

1. Determine whether you need an isolator.

   If you connect Channel 0 to a modem or an ASCII device, consider installing an isolator between the controller and modem or ASCII device. An isolator is also recommended when connecting Channel 0 directly to a programming workstation.

   **TIP** If you connect to Channel 1 of the CompactLogix5330, an isolator is not needed.

   One possible isolator is the 1761-NET-AIC interface converter.




**WARNING**

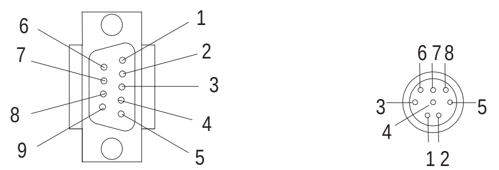
EXPLOSION HAZARD

The 1761-NET-AIC is rated Class I, Division 2. An external power supply must be used in hazardous locations, and the DC Power Source selector switch must be in the EXTERNAL position before connecting the power supply to the AIC+.

Refer to the Advanced Interface Converter (AIC+) User Manual, publication 1761-6.4 for installation requirements, especially if operating in a hazardous area.

**2.** Select the appropriate cable.

| If you are using an isolator: | Use this cable: |
|---|---|
| yes | The 1761-CBL-AP00 cable (right-angle bend connector to controller) or the 1761-CBL-PM02 cable (straight connector to the controller) attaches the controller to port 2 on the 1761-NET-AIC isolator. The 8-pin mini-DIN connector is not commercially available, so you cannot make this cable. |

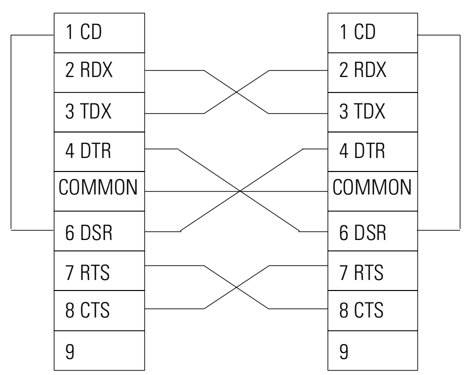



DB-9 right-angle or straight cable end

8-pin, mini-DIN cable end

| Pin: | DB-9 end: | Mini-DIN end: |
|---|---|---|
| 1 | DCD | DCD |
| 2 | RxD | RxD |
| 3 | TxD | TxD |
| 4 | DTR | DTR |
| 5 | ground | ground |
| 6 | DSR | DSR |
| 7 | RTS | RTS |
| 8 | CTS | CTS |
| 9 | na | na |

| | |
|---|---|
| no | The 1756-CP3 cable attaches the controller directly to the RS-232 device. |



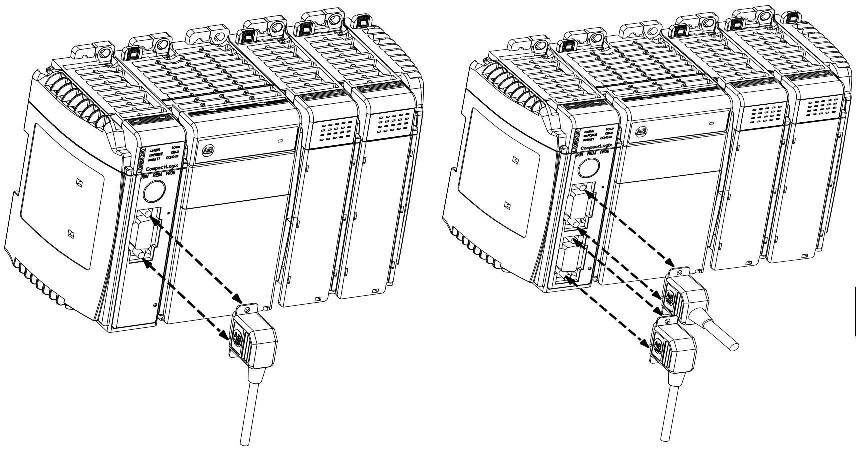

straight cable end

right-angle cable end

If you make your own cable, it must be shielded and the shield must be tied to the metal shell (that surrounds the pins) on the end of the cable.

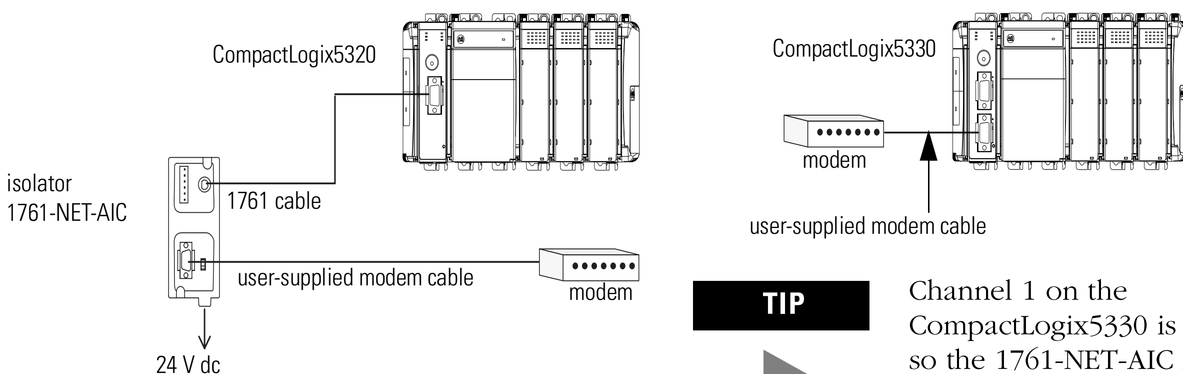
You can also use a 1747-CP3 cable from the SLC product family. This cable has a larger right-angle connector than the 1756-CP3 cable.

3. Connect the appropriate cable to the serial port(s) on the controller. To connect two cables to the CompactLogix5330, attach the straight-end connector to Channel 0.



**TIP** The Channel 0 port is locally grounded.

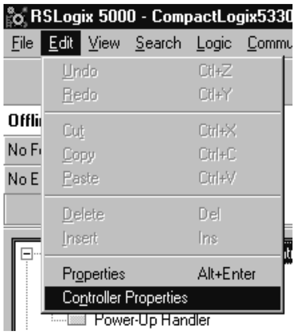
4. If necessary, attach the controller to the isolator.




**TIP** Channel 1 on the CompactLogix5330 is isolated, so the 1761-NET-AIC is not required.

**ATTENTION** The CompactLogix controller is grounded through its DIN rail or mounting foot. It is important that you understand the workstation's grounding system before connecting it to the controller. An isolator is recommended between Channel 0 of the controller and the workstation.

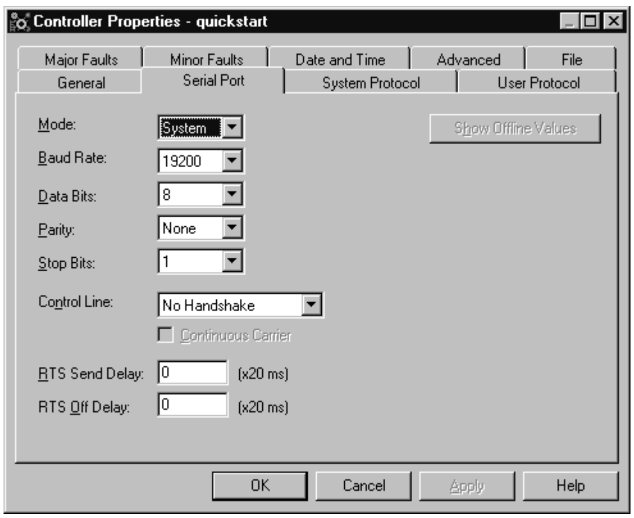
## Step 2: Configure the Serial Port(s) of the Controller



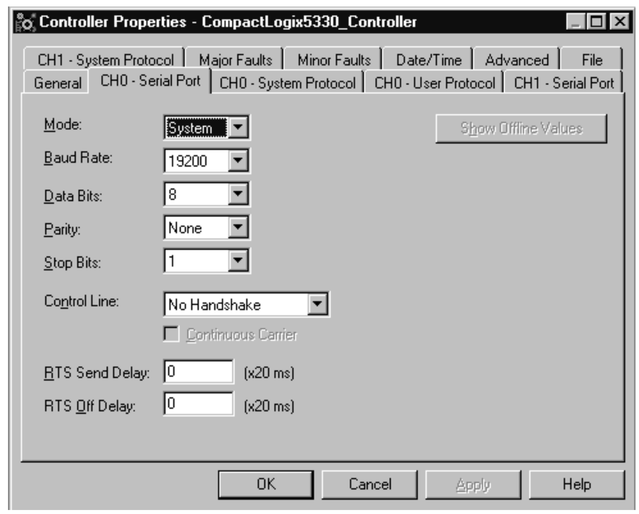

1. In RSLogix 5000 software, select Edit → Controller Properties.

2. On the Serial Port tab(s), specify the proper mode and the appropriate serial communication settings.

CompactLogix5320 with one serial port.




CompactLogix5330 with two serial ports.




3. On the System Protocol tab(s), select DH-485 or the appropriate DF1 communication mode for point-to-point or master/slave communications. Or on the User Protocol tab, select ASCII to communicate with an ASCII device (Channel 0 only).

*Specifying Serial Port Characteristics*

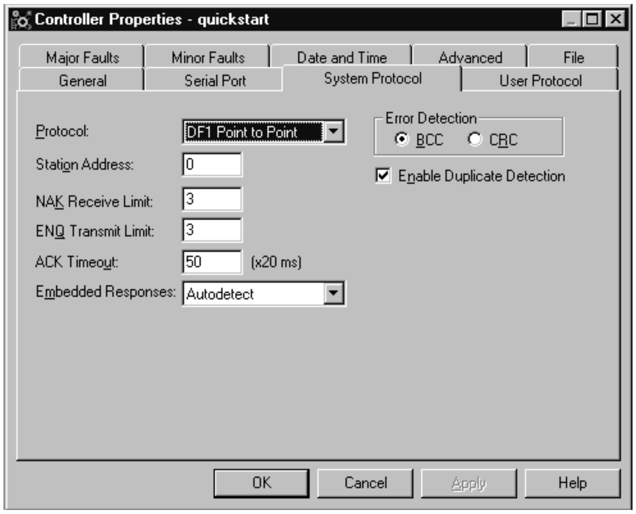
Specify these characteristics on the Serial Port tab(s) (default values are shown in bold):

| Characteristic: | Description (default is shown in bold): |
|---|---|
| Mode | Select **System** (for DF1 and DH485 communication) or User mode (for ASCII communication). User mode is not available for Channel 1 at this time. |
| Baud rate | Specifies the communication rate for the serial port. Select a baud rate that all devices in your system support.<br>Select 110, 300 600, 1200, 2400, 4800, 9600, **19200**, 38400 Kbps.<br>Note: 38400 Kbps only in DF1 mode |
| Parity | Specifies the parity setting for the serial port. Parity provides additional message-packet error detection.<br>Select **None** or Even. |
| Data bits | Specifies the number of bits per message packet.<br>Select **8**. |
| Stop bits | Specifies the number of stop bits to the device with which the controller is communicating.<br>Select **1** or 2. |
| Control line | Specifies the mode in which the serial driver operates.<br>Select **No Handshake**, Full-Duplex, Half-Duplex with Continuous Carrier, or Half-Duplex without Continuous Carrier.<br>If you are not using a modem, select No Handshake.<br>If both modems in a point-to-point link are full-duplex, select Full-Duplex for both controllers.<br>If the master modem is full-duplex and the slave modem is half-duplex, select Full-Duplex for the master controller and select Half-Duplex with Continuous Carrier for the slave controller.<br>If all the modems in the system are half-duplex, select Half-Duplex without Continuous Carrier for the controller. |
| RTS send delay[1] | Enter a count that represents the number of 20 ms periods of time that elapse between the assertion of the RTS signal and the beginning of a message transmission. This time delay lets the modem prepare to transmit a message. The CTS signal must be high for the transmission to occur.<br>The range is **0** to +32767 periods. |
| RTS off delay[1] | Enter a count that represents the number of 20 ms periods of time that elapse between the end of a message transmission and the de-assertion of the RTS signal. This time delay is a buffer to make sure the modem successfully transmits the entire message.<br>The range is **0** to +32767 periods. Normally leave this setting at zero. |

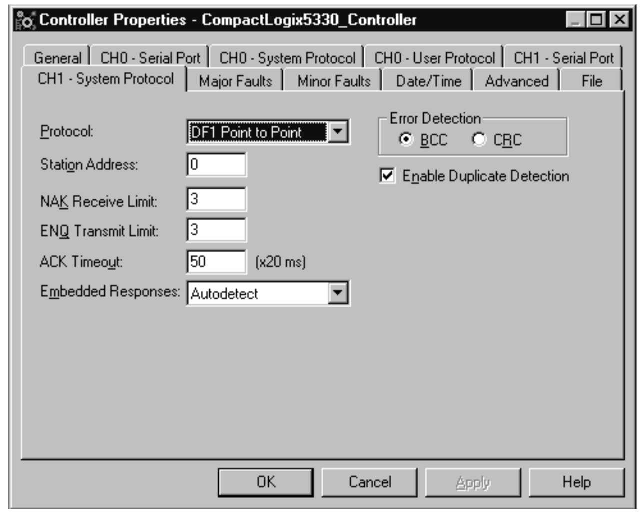
(1) This parameter is especially useful for communicating via radio modems.

*Specifying System Protocol Characteristics*

CompactLogix5320 with one serial port.




CompactLogix5330 with two serial ports.



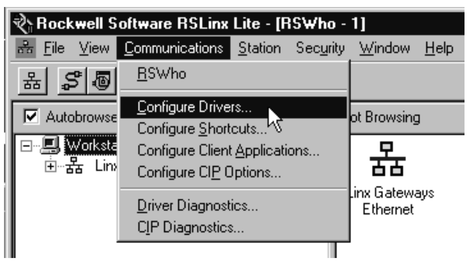

The available system modes are:

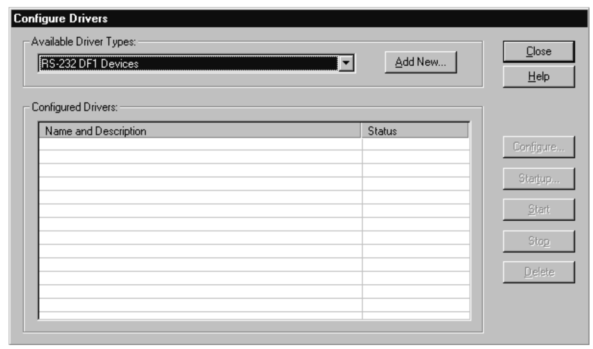
| Use this mode: | For: | See page: |
|---|---|---|
| DF1 point-to-point | communication between the controller and one other DF1-protocol-compatible device.<br>This is the default system mode.<br>This mode is typically used to program the controller through its serial port. | 4-11 |
| DF1 master mode | control of polling and message transmission between the master and slave nodes.<br>The master/slave network includes one controller configured as the master node and as many as 254 slave nodes. Link slave nodes using modems or line drivers.<br>A master/slave network can have node numbers from 0 to 254. Each node must have a unique node address. Also, at least 2 nodes must exist to define your link as a network (1 master and 1 slave station are the two nodes). | 4-14 |
| DF1 slave mode | using a controller as a slave station in a master/slave serial communication network.<br>When there are multiple slave stations on the network, link slave stations using modems or line drivers to the master. When you have a single slave station on the network, you do not need a modem to connect the slave station to the master. You can configure the control parameters for no handshaking. You can connect 2 to 255 nodes to a single link. In DF1 slave mode, a controller uses DF1 half-duplex protocol.<br>One node is designated as the master and it controls who has access to the link. All the other nodes are slave stations and must wait for permission from the master before transmitting. | 4-14 |
| User mode<br>(Channel 0 only) | communicating with ASCII devices.<br>This requires your program logic to use the ASCII instructions to read and write data from and to an ASCII device. | 4-16 |
| DH-485 | communicating with other DH-485 devices multi-master, token passing network allowing programming and peer-to-peer messaging. | 5-1 |

## Step 3: Configure the Programming Terminal Communication Driver

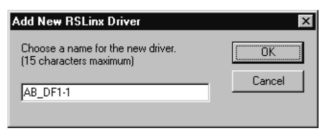
Use RSLinx software to configure the serial communication driver. Select the “DF1” driver.

1. In RSLinx software, select Communication — Configure Driver. From the Available Driver Types list, select”RS-232 DF1 Devices“. Click Add New.



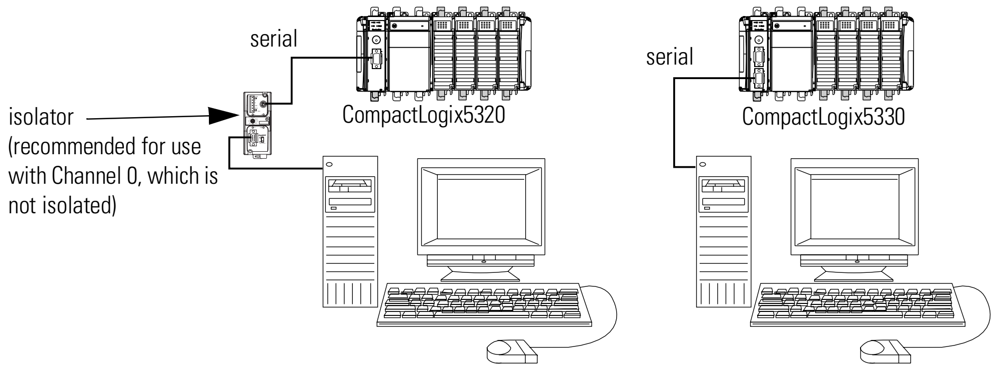

2. Specify a name for the driver.




3. Specify the appropriate communication settings. Select the “Logix5550/CompactLogix” as the Device and specify the COM port. Click Autoconfigure to have the software determine the remaining serial settings.

## Example 1: Workstation Directly Connected to a CompactLogix Controller

In the following example, a workstation directly connects to a CompactLogix controller over a serial link. This is useful for downloading a controller project directly to the controller.




This type of protocol supports simultaneous transmission between two devices in both directions. The DF1 point-to-point protocol controls message flow, detects and signals errors, and retries if errors are detected.

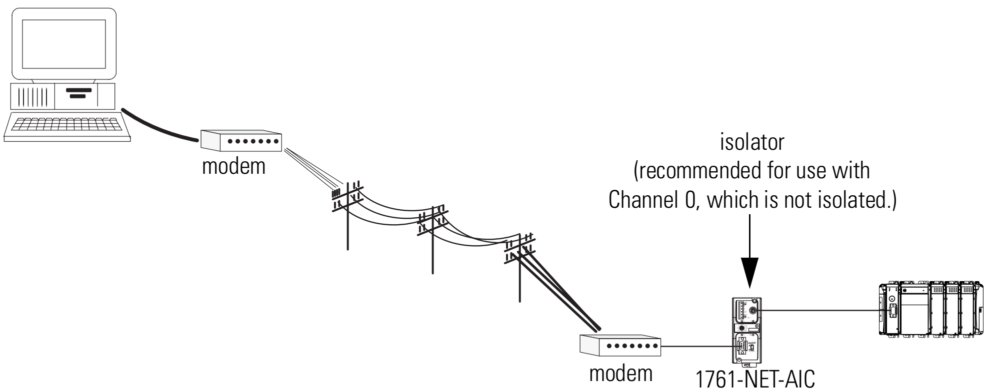
### Configuring a DF1 Point-to-Point Station

| This field: | Description: |
|---|---|
| Station address | The station address for the serial port on the DF1 point-to-point network. Enter a valid DF1 address (0 to 254). Address 255 is reserved for broadcast messages. The default is 0. |
| NAK receive limit | Specifies the number of NAKs the controller can receive in response to a message transmission.<br>Enter a value 0 to 127. The default is 3. |
| ENQ transmit limit | Specifies the number of inquiries (ENQs) you want the controller to send after an ACK timeout.<br>Enter a value 0 to 127. The default is 3. |
| ACK timeout | Specifies the amount of time you want the controller to wait for an acknowledgment to its message transmission.<br>Enter a value 0 to 32767. Limits are defined in 20 ms intervals. The default is 50 (1000 ms). |
| Embedded response | Specifies how to enable embedded responses.<br>Select Autodetect (enabled only after receiving one embedded response) or Enabled. The default is Autodetect. |
| Error detection | Select BCC or CRC error detection.<br>Configure both stations to use the same type of error checking.<br>**BCC:** the controller sends and accepts messages that end with a BCC byte for error checking. BCC is quicker and easier to implement in a computer driver. This is the default.<br>**CRC:** the controller sends and accepts messages with a 2-byte CRC for error checking. CRC is a more complete method. |
| Enable duplicate detection | Select whether or not the controller should detect duplicate messages. The default is duplicate detection enabled. |

For information about communicating on DeviceNet with the 1761-NET-DNI or on Ethernet with the 1761-NET-ENI, see Appendix F, Communications on DeviceNet, or Appendix G, Communications on Ethernet.

## Example 2: Workstation Remotely Connected to a CompactLogix Controller

In the following example, a workstation remotely connects to a CompactLogix controller over a serial link. A modem is connected to the controller to provide remote access.




If you use a modem to remotely connect the controller to one workstation, use DF1 point-to-point (full-duplex) protocol, as in the previous example.

### Master/Slave Communication Methods

*Half-duplex DF1 Protocol*

Half-duplex master/slave protocol is a SCADA protocol, consisting of 1 master and up to 254 slaves. Typically, the master polls all of the slaves for data in a round-robin fashion, using RF modems, leased-line modems, or any similar media.

A master station can communicate with a slave station in two ways:

| Name: | This method: | Benefits: |
|---|---|---|
| standard communication mode | initiates polling packets to slave stations according to their position in the polling array(s). Polling packets are formed based on the contents of the normal poll array and the priority poll array. | This communication method is most often used for point-to-multipoint configurations.<br>This method provides these capabilities:<br>• slave stations can send messages to the master station (polled report-by-exception)<br>• slave stations can send messages to each other via the master (slave-to-slave transfers)<br>• master maintains an active station array<br>The poll array resides in a user-designated data file. You can configure the master:<br>• to send messages during its turn in the poll array<br>*or*<br>• for between-station polls (master transmits any message that it needs to send before polling the next slave station)<br>In either case, configure the master to receive multiple messages or a single message per scan from each slave station. |
| message-based communication mode | initiates communication to slave stations using only user-programmed message (MSG) instructions.<br>Each request for data from a slave station must be programmed via a MSG instruction.<br>The master polls the slave station for a reply to the message after waiting a user-configured period of time. The waiting period gives the slave station time to formulate a reply and prepare the reply for transmission. After all of the messages in the master's message-out queue are transmitted, the slave-to-slave queue is checked for messages to send. | If your application uses satellite transmission or public switched-telephone-network transmission, consider choosing message-based communication. Communication to a slave station can be initiated on an as-needed basis.<br>Also choose this method if you need to communicate with non-intelligent remote terminal units (RTUs). |

## Configuring a DF1 Slave Station

| This field: | Description: |
|---|---|
| Station address | The station address for the serial port on the DF1 slave.<br>Enter a valid DF1 address (0 to 254). Address 255 is reserved for broadcast messages. The default is 0. |
| Transmit retries | The number of times the remote station retries a message after the first attempt before the station declares the message undeliverable.<br>Enter a value 0 to 127. The default is 3. |
| Slave poll timeout | Specifies the amount of time the slave station waits to be polled by a master before indicating a fault.<br>Enter a value 0 to 32767. Limits are defined in 20 ms intervals. The default is 3000 (60,000 ms). |
| EOT suppression | Select whether or not to suppress sending EOT packets in response to a poll. The default is *not* to suppress sending EOT packets. |
| Error detection | Select BCC or CRC error detection.<br>Configure both stations to use the same type of error checking.<br>**BCC:** the controller sends and accepts messages that end with a BCC byte for error checking. BCC is quicker and easier to implement in a computer driver. This is the default.<br>**CRC:** the controller sends and accepts messages with a 2-byte CRC for error checking. CRC is a more complete method. |
| Enable duplicate detection | Select whether or not the controller should detect duplicate messages. The default is duplicate detection enabled. |

## Configuring a DF1 Master Station

| This field: | Description: |
|---|---|
| Station address | The station address for the serial port on the DF1 master.<br>Enter a valid DF1 address (0 to 254). Address 255 is reserved for broadcast messages. The default is 0. |
| Transmit retries | Specifies the number of times a message is retried after the first attempt before being declared undeliverable.<br>Enter a value 0 to 127. The default is 3. |
| ACK timeout | Specifies the amount of time you want the controller to wait for an acknowledgment to its message transmission.<br>Enter a value 0 to 32767. Limits are defined in 20ms intervals. The default is 50 (1000 ms). |
| Reply message wait | **Message-based polling mode only**<br>Specifies the amount of time the master station waits after receiving an ACK to a master-initiated message before polling the slave station for a reply.<br>Enter a value 0 to 65535. Limits are defined in 20ms intervals. The default is 5 (100 ms). |
| Polling mode | Select one of these:<br>• Message Based (slave cannot initiate messages)<br>• Message Based (slave can initiate messages) - default<br>• Standard (multiple message transfer per node scan)<br>• Standard (single message transfer per node scan) |
| Master transmit | **Standard polling modes only**<br>Select when the master station sends messages:<br>• between station polls (default)<br>• in polling sequence |

| This field: | Description: |
|---|---|
| Normal poll node tag | **Standard polling modes only**<br>An integer tag array that contains the station addresses of the slave stations.<br>Create a single-dimension array of data type INT that is large enough to hold all the normal station addresses. The minimum size is three elements.<br>This tag must be controller-scoped. The format is:<br>*list[0]* contains total number of stations to poll<br>*list[1]* contains address of station currently being polled<br>*list[2]* contains address of first slave station to poll<br>*list[3]* contains address of second slave station to poll<br>*list[n]* contains address of last slave station to poll |
| Normal poll group size | **Standard polling modes only**<br>The number of stations the master station polls after polling all the stations in the priority poll array. Enter 0 (default) to poll the entire array. |
| Priority poll node tag | **Standard polling modes only**<br>An integer tag array that contains the station addresses of the slave stations you need to poll more frequently.<br>Create a single-dimension array of data type INT that is large enough to hold all the priority station addresses. The minimum size is three elements.<br>This tag must be controller-scoped. The format is:<br>*list[0]* contains total number of stations to be polled<br>*list[1]* contains address of station currently being polled<br>*list[2]* contains address of first slave station to poll<br>*list[3]* contains address of second slave station to poll<br>*list[n]* contains address of last slave station to poll |
| Active station tag | **Standard polling modes only**<br>An array that stores a flag for each of the active stations on the DF1 link.<br>Both the normal poll array and the priority poll array can have active and inactive stations. A station becomes inactive when it does not respond to the master's poll.<br>Create a single-dimension array of data type SINT that has 32 elements (256 bits). This tag must be controller-scoped. |
| Error detection | Select BCC or CRC error detection.<br>Configure both stations to use the same type of error checking.<br>**BCC:** the controller sends and accepts messages that end with a BCC byte for error checking. BCC is quicker and easier to implement in a computer driver. This is the default.<br>**CRC:** the controller sends and accepts messages with a 2-byte CRC for error checking. CRC is a more complete method. |
| Enable duplicate detection | Select whether or not the controller should detect duplicate messages. The default is duplicate detection enabled. |

### *If You Choose One of the Standard Polling Modes*

The master station polls the slave stations in this order:

1. all stations that are active in the priority poll array

2. one station that is inactive in the priority poll array

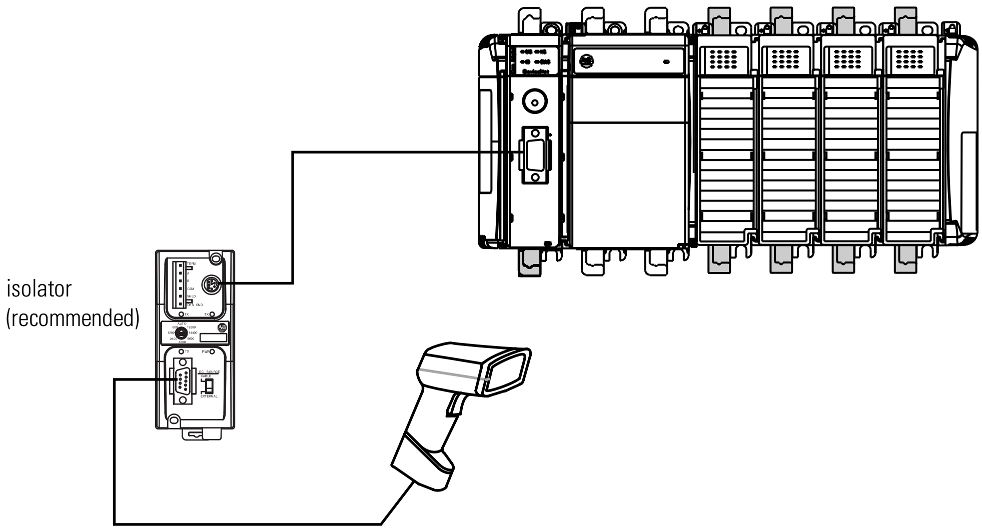
3. the specified number (normal poll group size) of active stations in the normal poll array

4. one inactive station, after all the active stations in the normal poll array have been polled

Use the programming software to change the display style of the active station array to binary so you can view which stations are active.

## Example 3: CompactLogix Controller Connected to a Bar Code Reader

In the following example, a workstation connects to a bar code reader. A bar code reader is an ASCII device, so you configure the serial port differently than in the previous examples. Configure the serial port for User mode, rather than the system mode.



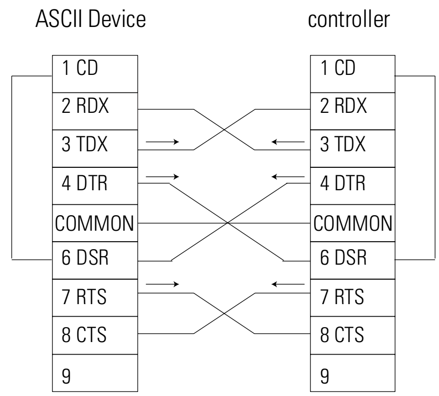
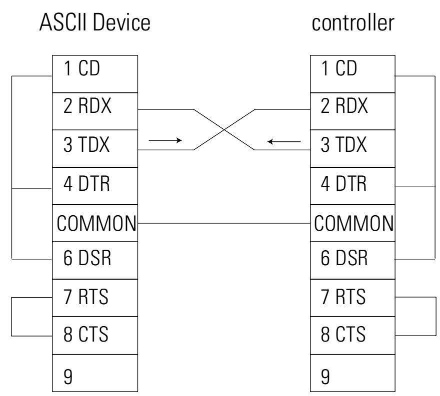

**IMPORTANT** You must use Channel 0 when connecting to an ASCII device. Channel 1 on the CompactLogix5330 does not support ASCII at this time.

### Connect the ASCII Device to the Controller

To connect the ASCII device to the Channel 0 serial port of the controller:

1. For the serial port of the ASCII device, determine which pins send signals and which pins receive signals.

2. Connect the sending pins to the corresponding receiving pins and attach jumpers:

| If the communications hardware handshaking is: | Then wire the connectors as follows: |
|---|---|
| enabled |  |
| *disabled* |  |

3. Attach the cable shield to both connectors and tie the cable to both connectors.

4. Connect the cable to the controller and the ASCII device.

The following table lists the default serial port configuration settings for the ASCII protocol. You specify these settings on the User Protocol tab under Controller Properties.

## Configuring User Mode

| This field: | Description: |
|---|---|
| Buffer size | Specify the maximum size (in bytes) of the data array you plan to send and receive. The default is 82 bytes. |
| Termination characters | Specify the characters you will use to designate the end of a line. The default characters are '$r' and '$FF'. |
| Append characters | Specify the characters you will append to the end of a line. The default characters are '$r' and '$l'.(1) |
| XON/XOFF | Select whether or not to regulate the flow of incoming data. The default is disabled. |
| Echo mode | Select whether or not to echo data back to the device from which it was sent. The default is disabled. |
| Delete mode | Select Ignore, CTR, or Printer for the delete mode. The default is Ignore. |

(1) IEC 1131-3 representation for carriage return and line feed.

## Programming ASCII Instructions

Both of the CompactLogix controllers support ASCII instructions on Channel 0. However, at this time, the CompactLogix5330 controller *does not* support ASCII instructions on Channel 1. ASCII instructions are used to communicate with ASCII devices. Your RSLogix5000 programming software CDROM includes programming examples using ASCII instructions.

For information about using these examples, see the *Logix5000 Controllers General Instruction Set Reference Manual*, publication 1756-RM003D-EN-P.

# Communicating with Devices on a DH-485 Link

**TIP**

The CompactLogix controllers serial port(s) now support the ability to communicate using the DH-485 protocol. This extends the communications capabilities of the CompactLogix controllers and adds to the support of DF1 and User ASCII that was previously provided. By using a 1761-NET-AIC and the appropriate RS232 cable (1756-CP3 or 1747-CP3), a CompactLogix controller can send and receive data on a DH-485 network with SLC controllers and PanelView displays.

While the DH-485 protocol can be used to send and receive messages, excessive traffic on the DH-485 network may make it impractical to connect to your CompactLogix controller with RSLogix 5000 programming software. In this case, program upload/download, monitoring and online editing of programs via DH-485 can be accomplished when the system is not running and the controllers are in program mode.

In addition, when attempting to go online or upload/download a program using the Communications/Who Active window in RSLogix 5000, disable the Autobrowse feature to minimize traffic from RSLogix 5000 on the DH-485 network.

The DH-485 network is not recommended for new applications using CompactLogix controllers. CompactLogix controllers should be used on DH-485 networks only when adding these controllers to an existing DH-485 network. For new applications with CompactLogix controllers, DeviceNet and Ethernet are the recommended networks.

## Using This Chapter

The DH-485 protocol uses RS-485 half-duplex as its physical interface. (RS-485 is a definition of electrical characteristics; it is *not* a protocol.) You can configure the RS-232 port of the CompactLogix controller to act as a DH-485 interface.



**IMPORTANT** A DH-485 network consists of multiple cable segments. Limit the total length of all the segments to 1219m (4000 ft.).

## Configuring Your System for a DH-485 Link

For the CompactLogix controller to operate on a DH-485 network, you need:

- a 1761-NET-AIC interface converter for each CompactLogix controller you want to put on the DH-485 network.

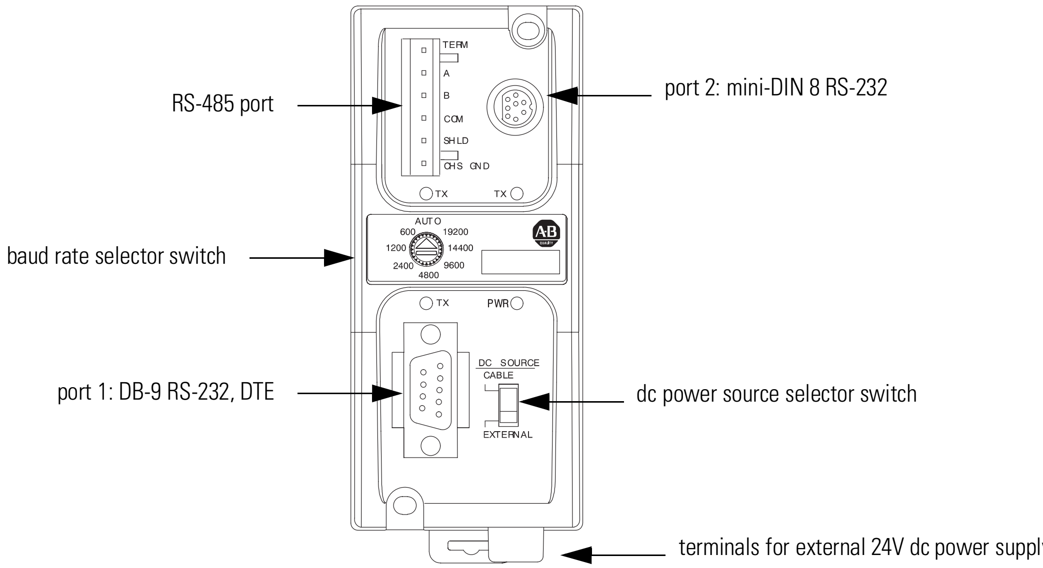
  You could have two controllers per one 1761-NET-AIC converter, but you would need a different cable for each controller. Connect one controller to port 1 (9-pin connector) and one controller to port 2 (mini-DIN connector).

- RSLogix 5000 programming software to configure the serial port of the controller for DH-485 communications.

### Step 1: Configure the Hardware

The Channel 0 RS-232 port is a non-isolated serial port built-in to the front of the CompactLogix controller. Channel 1 on CompactLogix5330 is an isolated RS-232 port. The RS-232 port(s) support the requirements you need for the DH-485 network connection.

Connect the controller to an RS-232-to-RS-485 isolator. One possible isolator is the 1761-NET-AIC interface converter.



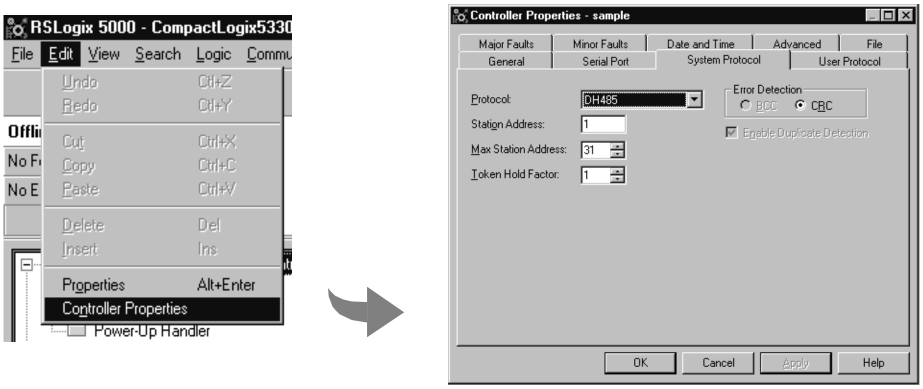

Connect the serial port of the CompactLogix controller to either port 1 or port 2 of the 1761-NET-AIC converter. Use the RS-485 port to connect the converter to the DH-485 network.

The cable you use to connect the controller depends on the port you use on the 1761-NET-AIC converter.

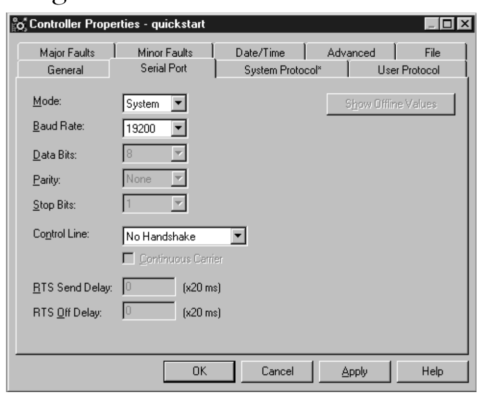
| If you connect to this port: | Use this cable: |
|---|---|
| port 1<br>DB-9 RS-232, DTE connection | 1747-CP3<br>or<br>1761-CBL-AC00 |
| port 2<br>mini-DIN 8 RS-232 connection | 1761-CBL-AP00<br>or<br>1761-CBL-PM02 |

## Step 2: Configure the DH-485 Port of the Controller

1. In RSLogix 5000 software, select Edit → Controller Properties. On the System Protocol tab, select DH-485.




2. On the Serial Port tab, specify the appropriate communication settings.




The grayed out settings are selections that do not apply to a DH-485 network.

Specify these characteristics on the Serial Port tab (default values are shown in bold):

| Characteristic: | Description (default is shown in bold): |
| --- | --- |
| Baud Rate | Specifies the communication rate for the DH-485 port. All devices on the same DH-485 network must be configured for the same baud rate. Select 9600 or **19200** Kbps. |
| Node Address | Specifies the node address of the CompactLogix controller on the DH-485 network. Select a number **1**-31 decimal, inclusive.<br>To optimize network performance, assign node addresses in sequential order. Initiators, such as personal computers, should be assigned the lowest address numbers to minimize the time required to initialize the network. |
| Token Hold Factor | Specifies the number of messages sent per token possession. Select a number **1**-4, inclusive. |
| Maximum Node Address | Specifies the maximum node address of all the devices on the DH-485 network. Select a number 1-**31** decimal, inclusive.<br>To optimize network performance, make sure:<br>• the maximum node address is the highest node number being used on the network<br>• that all the devices on the same DH-485 network have the same selection for the maximum node address. |

## Planning a DH-485 Network

The DH-485 network offers:

- interconnection of 32 devices
- multi-master capability
- token passing access control
- the ability to add or remove nodes without disrupting the network
- maximum network length of 1219 m (4000 ft.)

The DH-485 protocol supports two classes of devices: initiators and responders. All initiators on the network get a chance to initiate message transfers. The DH-485 protocol uses a token-pass algorithm to determine which initiator has the right to transmit.

### DH-485 Token Rotation

A node holding the token can send any valid packet onto the network. As a default, each node gets only one transmission (plus two retries) each time it receives the token. After a node sends one message packet, it attempts to give the token to its successor by sending a “token pass” packet to its successor.

If no network activity occurs, the initiator sends the token pass packet again. After two retries (a total of three tries) the initiator attempts to find a new successor.

| IMPORTANT | The maximum address that the initiator searches for before starting again with zero is the value in the configurable parameter “maximum node address.” The default and maximum value for this parameter is 31 for all initiators and responders. |
|---|---|

The allowable range of the node address of a initiator is 0 to 31. The allowable address range for all responders is 1 to 31. There must be at least one initiator on the network.

## Network Initialization

The network requires at least one initiator to initialize it. Network initialization begins when a initiator on the network detects a period of inactivity that exceeds the time of a link dead timeout. When the link dead timeout is exceeded, usually the initiator with the lowest address claims the token. When a initiator has the token it will begin to build the network.

Building a network begins when the initiator that claimed the token tries to pass the token to the successor node. If the attempt to pass the token fails, or if the initiator has no established successor (for example, when it powers up), it begins a linear search for a successor starting with the node above it in the addressing.

When the initiator finds another active node, it passes the token to that node, which repeats the process until the token is passed all the way around the network to the initial node. At this point, the network is in a state of normal operation.

## Number of Nodes and Node Addresses

The number of nodes on the network directly affects the data transfer time between nodes. Unnecessary nodes (such as a second programming terminal that is not being used) slow the data transfer rate. The maximum number of nodes on the network is 32.

If the node addresses for controllers are assigned in sequence, starting at node 1 (with node 0 left for a programming terminal), it is as efficient to leave the maximum node address at 31 as it is to decrease

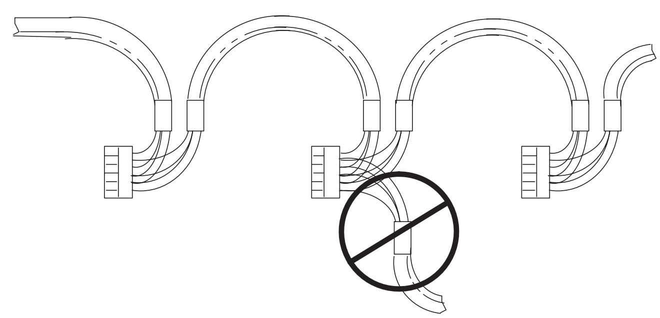
it to the highest node address on the network. Then, adding devices to the network at a later time will not require modifying the maximum node address in every device on the network. The maximum node address should be the same for all devices on a DH-485 network for optimal operation.

The best network performance occurs when node addresses start at 0 and are assigned in sequential order. The controller defaults to node address 1. Initiators, such as personal computers, should be assigned the lowest numbered addresses to minimize the time required to initialize the network.

## Installing a DH-485 Network

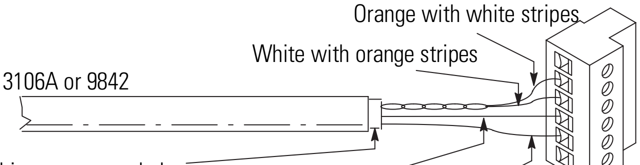
A DH-485 network consists of a number of cable segments daisy-chained together. The total length of the cable segments cannot exceed 1219 m (4000 ft).

**IMPORTANT** Use shielded, twisted-pair cable, either Belden 3106A or Belden 9842. A daisy-chained network is recommended.

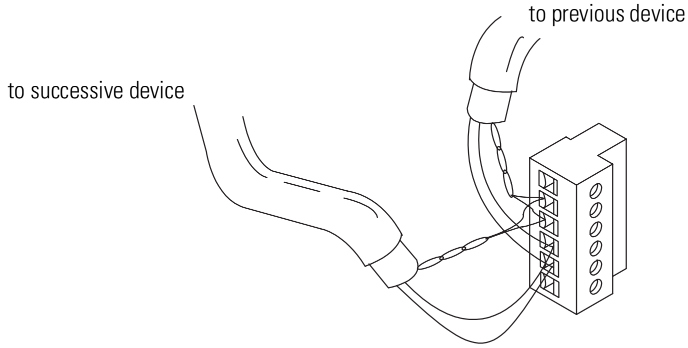


When cutting cable segments, make them long enough to route them from one link coupler to the next with sufficient slack to prevent strain on the connector. Allow enough extra cable to prevent chafing and kinking in the cable.

**Single Cable Connection**



**Multiple Cable Connection**




The table below shows wire/terminal connections for Belden 3106A.

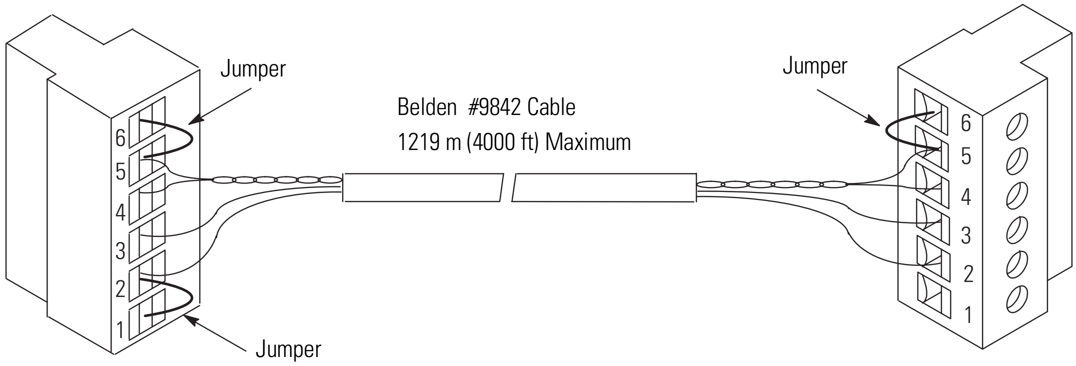
| For this Wire/Pair | Connect this Wire | To this Terminal |
|---|---|---|
| shield/drain | non-jacketed | 2 - Shield |
| blue | blue | 3 - (Common) |
| white/orange | white with orange stripe | 4 - (Data B) |
| | orange with white stripe | 5 - (Data A) |

The table below shows wire/terminal connections for Belden 9842.

| For this Wire/Pair | Connect this Wire | To this Terminal |
|---|---|---|
| shield/drain | non-jacketed | 2 - Shield |
| blue/white | white with blue stripe | cut back - no connection(1) |
| | blue with white stripe | 3 - (Common) |
| white/orange | white with orange stripe | 4 - (Data B) |
| | orange with white stripe | 5 - (Data A) |

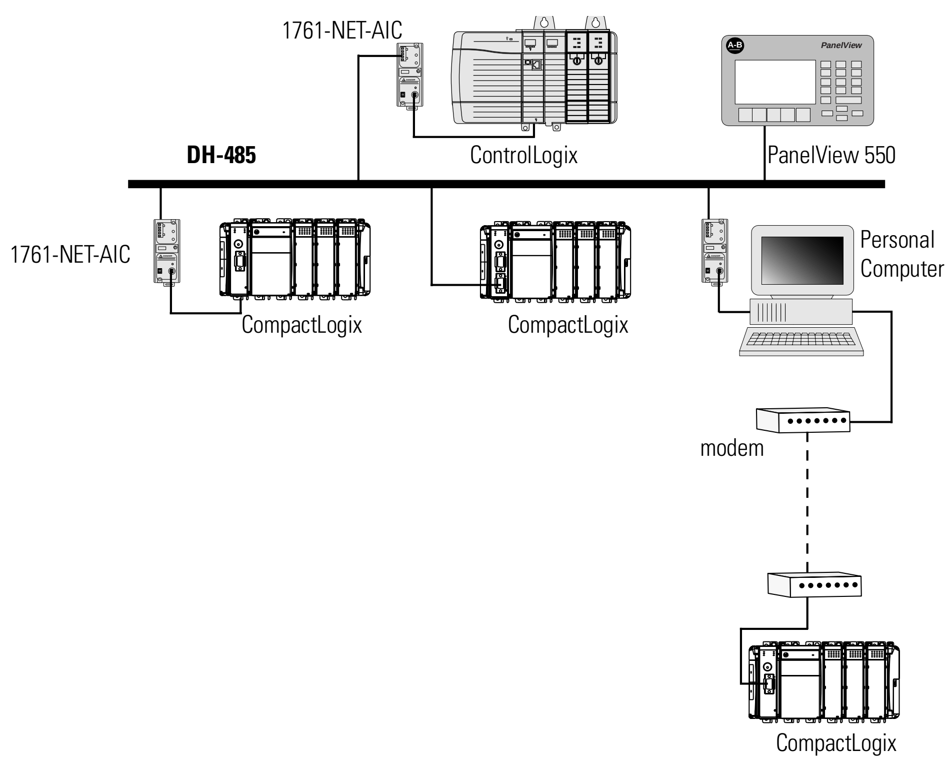
(1) To prevent confusion when installing the communication cable, cut back the white with blue stripe wire immediately after the insulation jacket is removed. This wire is not used by DH-485.

## Grounding and Terminating a DH-485 Network




## Example: CompactLogix Controller on a DH-485 Network

In the following example, both a CompactLogix controller and a ControlLogix controller use 1761-NET-AIC converters to connect to a DH-485 network.



# CompactLogix System Specifications

## Using This Appendix

| For information about: | See page |
|---|---|
| CompactLogix controller specifications | A-1 |
| 1747-BA battery specifications | A-2 |
| Dimensions | A-3 |

## CompactLogix Controller

| Description | CompactLogix5320 | CompactLogix5330 |
|---|---|---|
| Communication Ports | (1) RS-232 | (2) RS-232 |
| User Memory | 64K bytes | 256K bytes |
| Maximum number of I/O modules supported | 8 I/O modules | 16 I/O modules |
| Maximum number of I/O banks supported | 2 banks | 3 banks |
| Backplane Current | 600 mA at +5V dc<br>0 mA at +24V dc | 800 mA at +5V dc<br>0 mA at +24V dc |
| Operating Temperature | 0° to +60°C (+32° to +140°F) | |
| Storage Temperature | -40° to +85°C (-40° to +185°F) | |
| Relative Humidity | 5% to 95% non-condensing | |
| Vibration | Operating: 10 to 500 Hz, 5G, 0.030 in. peak-to-peak | |
| Shock | Operating: 30G, 11 ms, panel mounted<br>(20G, 11 ms, DIN rail mounted)<br>Non-operating: 40G, panel mounted<br>(30G, DIN rail mounted) | |
| Power Supply Distance Rating | 4 (The controller must be within 4 slot positions of the power supply.) | |
| Shipping Weight | 325 g (0.715 lbs) | 362 g (0.796 lbs) |
| Battery | 1747-BA | |
| Programming Cable | 1747-CP3 or 1756-CP3 | |
| Agency Certification | • C-UL certified (under CSA C22.2 No.142)<br>• UL 508 listed<br>• CE and C-Tick compliant for all applicable directives | |
| Hazardous Environment Class | Class I, Division 2, Hazardous Location,<br>Groups A, B, C, D<br>(UL 1604, C-UL under CSA C22.2 No. 213) | |
| Radiated and Conducted Emissions | EN50081-2 Class A | |

| Description | CompactLogix5320 | CompactLogix5330 |
|---|---|---|
| *Electrical /EMC:* | *The unit has passed testing at the following levels:* | |
| ESD Immunity (IEC61000-4-2) | 4 kV contact, 8 kV air, 4 kV indirect | |
| Radiated Immunity (IEC61000-4-3) | 10 V/m, 80 to 1000 MHz, 80% amplitude modulation, +900 MHz keyed carrier | |
| Fast Transient Burst (IEC61000-4-4) | 2 kV, 5 kHz | |
| Surge Immunity (IEC61000-4-5) | 1 kV galvanic gun | |
| Conducted Immunity (IEC61000-4-6) | 10V, 0.15 to 80 MHz(1) | |

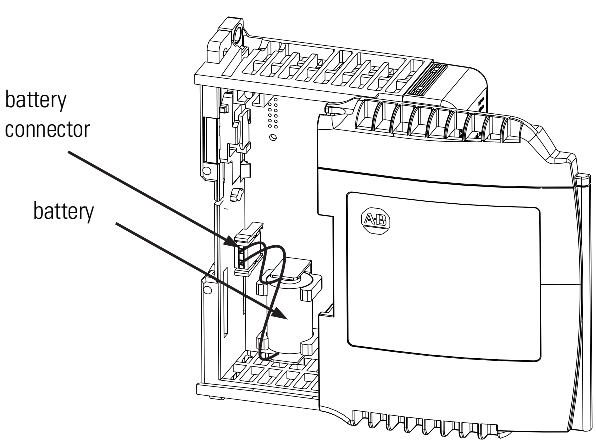
(1) Conducted Immunity frequency range may be 150 kHz to 30 MHz if the Radiated Immunity frequency range is 30 MHz to 1000 MHz.

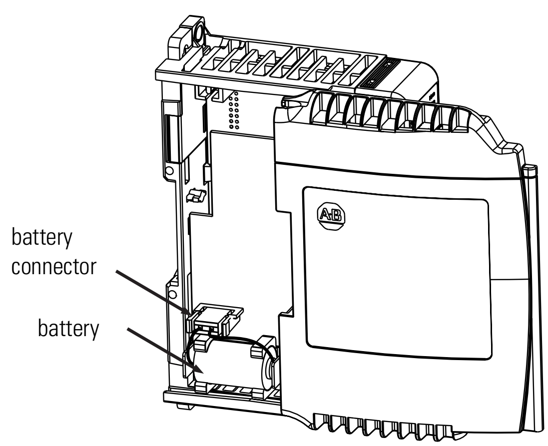
**IMPORTANT** The amount of memory that the software displays includes both the user available memory and the memory reserved for overhead. Certain operations dynamically allocate and de-allocate user-available memory. See the specifications for your controller and Appendix E to estimate how much memory you have available for programming.

## 1747-BA Battery

The CompactLogix controller uses the 1747-BA battery:

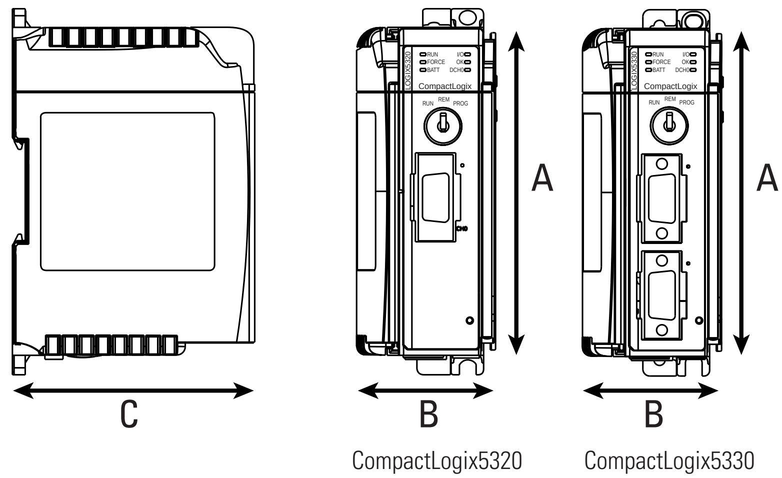
| | |
|---|---|
| **Battery** | 1747-BA<br>containing 0.59g lithium |



# Dimensions

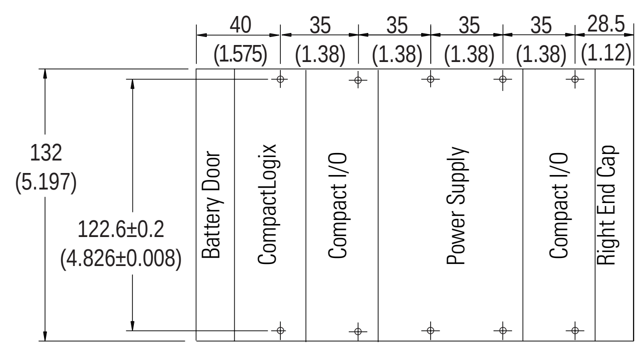
## CompactLogix Modular Controller




| Dimension | CompactLogix5320 and CompactLogix5330 |
|---|---|
| Height (A) | 118 mm (4.649 in.) |
| Width (B) | 50 mm (1.97 in.) |
| Depth (C) | 87 mm (3.43 in.) |

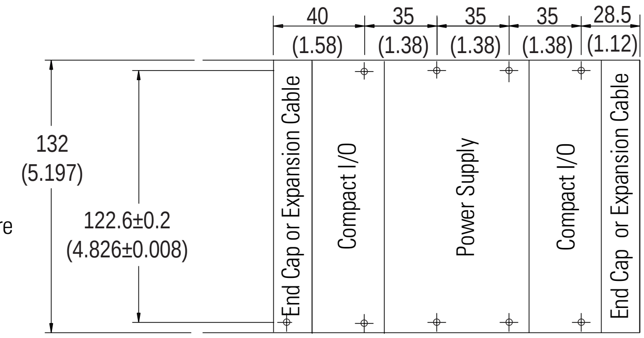
## CompactLogix System

NOTE: All dimensions are in mm (inches). Hole spacing tolerance: ±0.4 mm (0.016 in.)



## Compact I/O Expansion Power Supply and End Caps

NOTE: All dimensions are in mm (inches). Hole spacing tolerance: ±0.4 mm (0.016 in.)



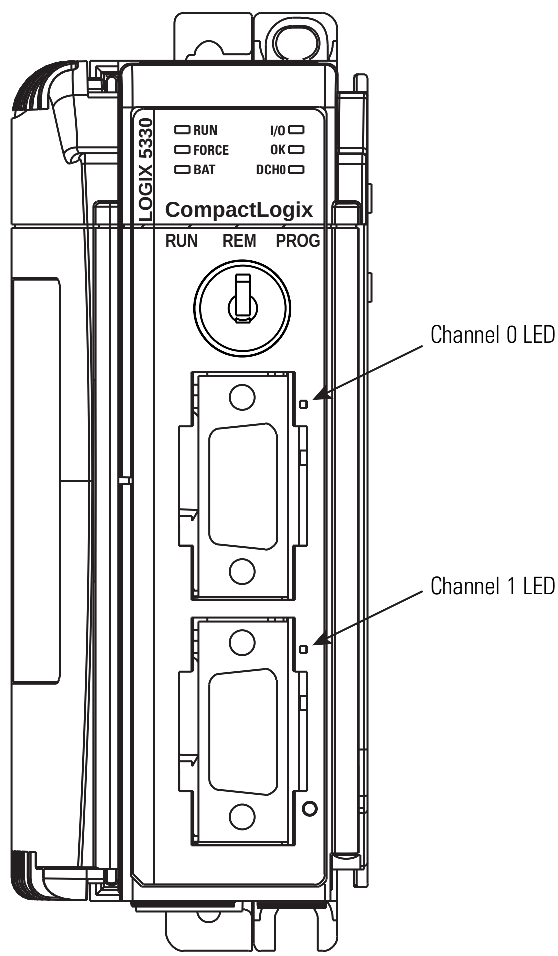

**TIP** Compact I/O expansion cables have the same dimensions as the end caps.

# CompactLogix Troubleshooting

## Using This Appendix



## CompactLogix Controller LEDs



The controller status LEDs provide a mechanism to determine the current status of the controller if a programming device is not present or available.

| Indicator | Color/Status | Description |
|---|---|---|
| RUN | Off | no task(s) running; controller in Program mode |
| | Green | one or more tasks are running; controller is in the Run mode |
| FORCE | Off | no forces enabled |
| | Amber | forces enabled |
| | Amber Flashing | one or more input or output addresses have been forced to an On or Off state, but the forces have not been enabled |
| BAT | Off | battery supports memory |
| | Red | battery may not support memory, replace battery |
| OK | Off | no power applied |
| | Green | controller OK |
| | Red flashing | recoverable controller fault |
| | Red | Non-recoverable controller fault:<br>Cycle power. The OK LED should change to flashing red.<br>If LED remains solid red, replace the controller. |
| I/O | Off(1) | no activity; no I/O or communications configured |
| | Green | communicating to all devices |
| | Green flashing | one or more devices not responding |
| | Red flashing | not communicating to any devices<br>controller faulted |
| DCH0 | Off | user-configured communications active |
| | Green | default communications active |
| Channel 0 | Off | no activity |
| | Green flickering | data is being received or transmitted |
| Channel 1 | Off | no activity |
| | Green flickering | data is being received or transmitted |

(1) If the controller does not contain an application (controller memory is empty), the I/O indicator will be off.

## Identifying Controller Faults

Refer to the *Logix5000 Controllers Common Procedures Manual,* publication number 1756-PM001C-EN-P, for a list of controller fault messages that can occur during operation of the CompactLogix controller. Each description includes the error code, the probable cause, and the recommended corrective action.

The *Logix5000 Controllers Common Procedures Manual* also contains procedures for monitoring faults and developing fault routines.

## Calling Rockwell Automation for Assistance

If you need to contact Rockwell Automation or local distributor for assistance, it is helpful to obtain the following (prior to calling):

- controller type, series letter, and revision letter of the unit
- series letter, revision letter, and firmware (FRN) number of the controller (as reported by the software)
- controller LED status
- controller error codes

# Maintaining the Battery

## Using this Appendix



## Storing Replacement Batteries

Because a battery may leak potentially dangerous chemicals if stored improperly, store batteries as follows:

**ATTENTION**

Store batteries in a cool, dry environment. We recommend 25°C with 40% to 60% relative humidity. You may store batteries for up to 30 days between -45° to 85°C, such as during transportation. To avoid possible leakage, *do not* store batteries above 60°C for more than 30 days.

## Estimating Battery Life

When the battery is about 95 percent discharged, the controller provides the following warnings:

- On the front of the controller, the BATTERY LED turns on (solid red).
- A minor fault occurs (type 10, code 10).

To estimate how long the battery will support the memory of the controller:

1. Determine the temperature (°C) 1 inch below the CompactLogix controller.

2. Determine the percentage of time that the controller is powered on per week.

**EXAMPLE**

If a controller is on:

- 8 hr/day during a 5-day work week
- all day Saturday and Sunday

Then the controller is on 52% of the time:

1. total hours per week = 7 x 24 = 168 hours
2. total on hours per week = (5 days x 8 hrs/day) + Saturday + Sunday = 88 hours
3. percentage on time = 88/168 = 52%

Use the on-time percentage you calculated with the following tables to determine battery life:

**CompactLogix5320 - Typical Minimum Battery Life**

| Time ON/OFF | at 25°C (77°F) | at 40°C (104°F) | at 60°C (140°F) |
|---|---|---|---|
| Always OFF | 12 months | 10 months | 7 months |
| ON 8 hours per day 5 days per week | 16 months | 13 months | 10 months |
| ON 16 hours per day 5 days per week | 23 months | 19 months | 14 months |
| Always ON | Not applicable(1) | | |

(1) There is almost no drain on the battery when the controller is always ON.

**CompactLogix5330 - Typical Minimum Battery Life**

| Time ON/OFF | at 25°C (77°F) | at 40°C (104°F) | at 60°C (140°F) |
|---|---|---|---|
| Always OFF | 67 months | 29 months | 11 months |
| ON 8 hours per day 5 days per week | 87 months | 38 months | 14 months |
| ON 16 hours per day 5 days per week | 127 months | 56 months | 20 months |
| Always ON | Not applicable(1) | | |

(1) There is almost no drain on the battery when the controller is always ON.

**Battery Duration After the LED Turns On**[1]

| Temperature | CompactLogix5320 | CompactLogix5330 |
|---|---|---|
| 60°C | 9 days | 8 days |
| 25°C | 14 days | 20 days |

(1) The battery indicator (BATTERY) warns you when the battery is low. These durations are the amounts of time the battery will retain processor memory from the time the controller is powered down after the LED first turns on.

**IMPORTANT** If the BATTERY LED turns on when you apply power to the controller, the battery life may be less than the tables above indicate. Some of the warning time may have been used while the controller was off and unable to turn on the BATTERY LED.

## Replacing a Battery

Because the controller uses a lithium battery, you must follow specific precautions when handling or disposing of a battery.

**ATTENTION** The controller uses a lithium battery, which contains potentially dangerous chemicals. Before handling or disposing of a battery, review *Guidelines for Handling Lithium Batteries*, publication AG-5.4.

Follow the procedure below to replace the battery.

**ATTENTION** The user program will be lost when the battery is removed. Make a copy of your user program before removing and replacing the battery.

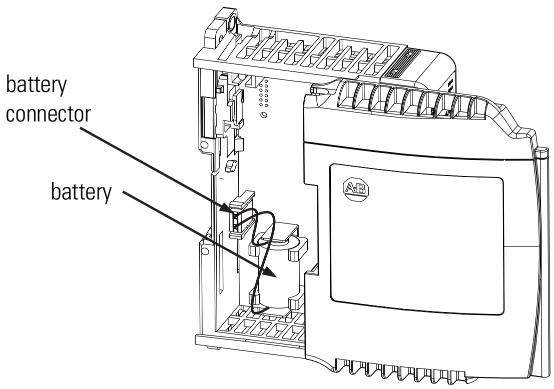
1. Save your user program.
2. Make sure the new 1747-BA battery is available and ready for installation.
3. Turn off power to the CompactLogix controller.

4. Does the existing battery show signs of leakage or damage?

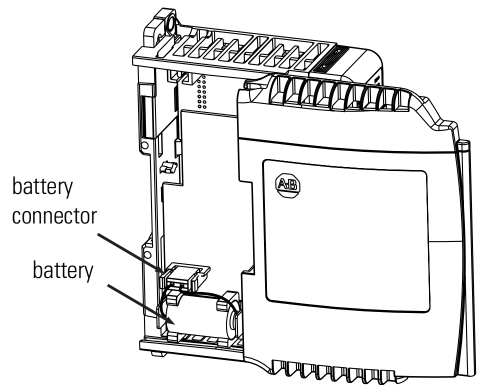
| If: | Then: |
|---|---|
| Yes | Before handling the battery, review *Guidelines for Handling Lithium Batteries*, publication AG-5.4. |
| No | Go to the next step. |

5. Remove the old battery.

**CompactLogix5320**




**CompactLogix5330**




6. Install a new 1747-BA battery. The battery connector is keyed to install only with the correct polarity.

**ATTENTION**

Only install a 1747-BA battery. If you install a different battery, you may damage the controller.

7. Write battery date on door of controller.

8. Apply power to the controller. On the front of the controller, is the BATTERY LED off?

| If: | Then: |
|---|---|
| Yes | Go to the next step. |
| No | Remove power, then:<br>A. Check that the battery is correctly connected to the controller.<br>B. If the BATTERY LED remains on, install another 1747-BA battery.<br>C. If the BATTERY LED remains on after you complete Step B., contact your Rockwell Automation representative or local distributor. |

9. Download your user program.

10. Dispose the old battery according to state and local regulations.

**ATTENTION**

Do not incinerate or dispose of lithium batteries in general trash collection. They may explode or rupture violently. Follow state and local regulations for disposal of these materials. You are legally responsible for hazards created while your battery is being disposed.

Appendix **D**

# Execution Time

## Using This Appendix

Use this appendix to calculate the time required for the execution of an instruction. Times are for the CompactLogix5320 controller (1769-L20) with RSLogix 5000 programming software, version 7.0; and the CompactLogix5330 controller (1769-L30) with RSLogix 5000 programming software, version 8.0.

| To estimate the execution time of a: | See page: |
|---|---|
| ladder instruction | D-1 |
| function block routine | D-12 |

**IMPORTANT** Actual execution times may vary because of the configuration of your project and the version of RSLogix 5000 software that you are using.

**IMPORTANT** These execution times were measured with the CompactBus inhibited.

## Estimate the Execution Time of a Ladder Instruction

To calculate the execution time of an instruction:

1. Use Table 4.B on page D-3 to find the base time for an instruction.

2. To the base time of the instruction, add time for expressions, subscripts, and data conversions:

| If an operand: | Then add time for: | Using this table: |
|---|---|---|
| contains an expression | each operation in the expression. For each operation, use the time for the corresponding instruction. | Table 4.B on page D-3 |
| is an element of an array and one or more of the subscripts is a tag (e.g., *tag_c[tag_d]*) | the calculation of the array subscript | Table 4.E on page D-12 |
| is converted by sign-extension | the data conversion | Table 4.A on page D-3 |
| contains a SINT or INT tag in an array subscript | the conversion of the SINT or INT to a DINT | |

## Examples (using CompactLogix5320 and RSLogix 5000 version 7):

| Instruction: | Data Type: | Execution Time: |
|---|---|---|
| CMP (*tag_a * tag_b / 100)* | | 4.6 µs overhead |
| * (MUL) | REAL | 19.1 µs for the MUL operation |
| / (DIV) | REAL | 19.9 µs for the DIV operation |
| | | 43.6 µs total |
| ADD | | 11.4 µs for the ADD instruction |
| Source A | DINT | 9.0 µs for DINT to REAL conversion |
| Source B | REAL | |
| Destination | REAL | |
| | | 20.4 µs total |
| ADD | | 11.4 µs for the ADD instruction |
| Source A | DINT[0,DINT] | 25.5 µs for array subscript<br>9.0 µs for DINT to REAL conversion of array element |
| Source B | REAL | |
| Destination | REAL | |
| | | 45.9 µs total |
| MUL | | 19.1 µs for MUL instruction |
| Source A | REAL | |
| Source B | DINT | 9.0 µs for DINT to REAL conversion |
| Destination | DINT | 13.2 µs for REAL to DINT conversion |
| | | 41.3 µs total |

# Reference Tables

**Table 4.A Sign-Extension Conversion Times**

| To convert a: | To a: | Requires (μs): |
|---|---|---|
| SINT | DINT | 1.1 |
| | REAL | 2.2 |
| INT | DINT | 1.2 |
| | REAL | 2.4 |
| DINT | SINT | 7.9 |
| | INT | 8.0 |
| | REAL | 9.0 |
| REAL | SINT | 15.9 |
| | INT | 16.0 |
| | DINT | 13.2 |

**Table 4.B Instruction Execution Time s**

| Instruction: | Optimal Data Type: | True Time (μs): | | False Time (μs): | Notes: |
|---|---|---|---|---|---|
| | | CompactLogix 5320 with RSLogix 5000 Version 7 | CompactLogix 5330 with RSLogix 5000 Version 8 | | |
| ABL | na | 13.6 | 14.0 | 11.8 | |
| ABS | DINT | 0.65 | 0.65 | 0.17 | |
| | REAL | 0.95 | 0.93 | 0.19 | |
| ACB | na | 13.3 | 13.7 | 11.7 | |
| ACL | na | 127.0 | 111.5 | 0.06 | |
| ACS | REAL | 289.3 | 285.7 | 0.12 | |
| ADD | DINT | 0.60 | 0.59 | 0.10 | |
| | REAL | 11.4 | 11.3 | 0.11 | |
| AFI | na | 0.06 | 0.05 | | |
| AHL | na | 13.7 | 88.7 | 12.1 | |
| AND | DINT | 0.64 | 0.62 | 0.11 | |
| ARD | na | 79.0 | 69.0 | 15.5 | |
| ARL | na | 79.2 | 69.2 | 15.5 | |
| ASN | REAL | 279.3 | 275.9 | 0.11 | |
| ATN | REAL | 238.6 | 235.6 | 0.11 | |
| AVE | REAL | 46.8 + (Length * 15.6) | 46.4 + (Length * 15.4) | 23.5 | |
| AWA | na | 82.6 | 70.9 | 15.3 | |
| AWT | na | 81.7 | 71.0 | 15.3 | |

**Table 4.B Instruction Execution Times (Continued)**

| Instruction: | Optimal Data Type: | True Time (μs): | | False Time (μs): | Notes: |
|---|---|---|---|---|---|
| | | CompactLogix 5320 with RSLogix 5000 Version 7 | CompactLogix 5330 with RSLogix 5000 Version 8 | | |
| BRK | na | 0 | | | |
| BSL | DINT | 8.4 + ((Length/32) * 0.83) | 8.27 + ((Length/32)*0.82) | 4.3 | Round up Length/32 to a whole number. |
| BSR | DINT | 9.3 + ((Length/32) * 0.83) | 9.16 + ((Length/32)*0.82) | 4.3 | Round up Length/32 to a whole number. |
| BTD | DINT | 10.61 | 10.47 | 0.16 | |
| CLR | DINT | 0.37 | 0.37 | 0.10 | |
| | REAL | 0.43 | 0.43 | 0.11 | |
| CMP | Refer to the operations within the expression. | 4.6 + *expression* | 4.5 | 0.11 | |
| COP | SINT | 7.4 + (Length * 0.09) | 7.3 + (Length * 0.09) | | |
| | INT | 7.1 + (Length * 0.19) | 7.0 + (Length * 0.18) | | |
| | DINT | 7.5 + (Length * 0.37) | 7.5 + (Length * 0.37) | 0.15 | |
| | REAL | 7.6 + (Length * 0.37) | 7.5 + (Length * 0.37) | 0.15 | |
| COS | REAL | 236.7 | 233.7 | 0.08 | |
| CPT | Refer to the operations within the expression. | 5.1 + *expression* | 5.0 + *expression* | 0.11 | |
| CTD | COUNTER | 0.46 | 0.45 | 0.43 | |
| CTU | COUNTER | 0.46 | 0.45 | 0.43 | |
| DDT | DINT | | | 9.1 | Based on All mode |
| 0 mismatches | | 29.6 + (Cmp. Length * 1.5) | 13.7 + (Cmp. Length * 1.5) | | |
| 1 mismatch | | 41.5 + (Cmp. Length * 1.5) | 29.2 + (Cmp. Length * 1.5) | | |
| 2 mismatches | | 44.2 + (Cmp. Length * 1.5) | 43.6 + (Cmp. Length * 1.5) | | |
| DEG | REAL | 20.0 | 19.7 | 0.11 | |
| DIV | DINT | 11.7 | 11.6 | 0.10 | |
| | REAL | 19.9 | 19.7 | 0.11 | |
| DTR | DINT | 3.02 | 2.99 | 2.8 | |
| EQU | DINT | 0.40 | 0.40 | 0.10 | |
| | REAL | 0.40 | 0.40 | 0.11 | |
| FAL | Refer to the operations within the expression. | 10.9 + (*n* * (4.3 + *expression*) | 10.77 + (*n* *(4.23 + *expression*) | 7.3 | *n* is the number of elements manipulated in one scan. |

**Table 4.B Instruction Execution Times (Continued)**

| Instruction: | Optimal Data Type: | True Time (µs): | | False Time (µs): | Notes: |
|---|---|---|---|---|---|
| | | CompactLogix 5320 with RSLogix 5000 Version 7 | CompactLogix 5330 with RSLogix 5000 Version 8 | | |
| FBC | DINT | | | 9.2 | |
| 0 mismatches | | 14.0 + (Cmp. Length * 1.5) | 13.8 + (Cmp. Length * 1.5) | | Based on All mode |
| 1 mismatch | | 13.9 + (Cmp. Length * 1.5) | 27.9 + (Cmp. Length * 1.5) | | |
| 2 mismatches | | 28.3 + (Cmp. Length * 1.5) | 40.9 + (Cmp. Length * 1.5) | | |
| FFL | SINT | 10.4 | 10.32 | | |
| | INT | 11.6 | 11.45 | | |
| | DINT | 10.8 | 10.71 | 7.5 | |
| | REAL | 10.8 | 10.72 | | |
| FFU | SINT | 11.8 + (Length * 0.66) | 11.7 + (Length * 0.65) | | |
| | INT | 12.9 + (Length * 1.11) | 12.72 + (Length * 1.10) | | |
| | DINT | 13.3 + (Length * 0.60) | 13.11 + (Length *0.59) | 7.7 | |
| | REAL | 13.3 + (Length * 0.60) | 13.12 + (Length *0.59) | 7.7 | |
| FLL | SINT | 4.7 + (Length * 0.31) | 4.7 + (Length *0.31) | | |
| | INT | 5.0 + (Length * 0.31) | 4.9 + (Length *0.31) | | |
| | DINT, REAL | 5.6 + (Length * 0.26) | 5.5 + (Length *0.25) | 0.16 | |
| FOR | DINT | 16.6 + ((Terminal value/Step size) * 7.8) | 16.4 + ((Terminal value/Step size) * 7.7) | 3.0 | |
| FRD | na | 9.6 | 9.4 | 0.10 | |
| FSC | Refer to the operations within the expression. | 11.4 + (*n* * (4.2 + *expression*) | 11.29 + (*n* * (4.12 + *expression*) | 7.8 | *n* is the number of elements manipulated in one scan. |
| GEQ | DINT | 0.40 | 0.40 | 0.11 | |
| | REAL | 0.63 | 0.62 | 0.11 | |
| GRT | DINT | 0.40 | 0.40 | 0.11 | |
| | REAL | 0.64 | 0.62 | 0.11 | |
| GSV | na | See Table 4.C on page D-9 | | 0.16 | |
| JMP | na | 1.6 | 1.7 | 0.10 | |
| JSR | na | 11.4 | 11.2 | | No parameters |

**Table 4.B Instruction Execution Times (Continued)**

| Instruction: | Optimal Data Type: | True Time (μs): | | False Time (μs): | Notes: |
|---|---|---|---|---|---|
| | | CompactLogix 5320 with RSLogix 5000 Version 7 | CompactLogix 5330 with RSLogix 5000 Version 8 | | |
| JSR/SBR | SINT | 23.0 + (*number of parameters* * 3.8) | 22.9 + (*number of parameters* * 3.7) | | The time is for the JSR/SBR pair. |
| | INT | 22.7 + (*number of parameters* * 4.2) | 22.8 + (*number of parameters* * 4.1) | | |
| | DINT | 22.8 + (*number of parameters* * 3.5) | 22.5 + (*number of parameters* * 3.5) | | |
| | REAL | 22.6 + (*number of parameters* * 3.6) | 22.7 + (*number of parameters* * 3.5) | | |
| JSR/RET | SINT | 22.2 + (*number of parameters* * 3.8) | 21.9 + (*number of parameters* * 3.8) | | The time is for the JSR/RET pair. |
| | INT | 21.8 + (*number of parameters* * 4.2) | 22.2 + (*number of parameters* * 4.1) | | |
| | DINT | 22.0 + (*number of parameters* * 3.5) | 22.0 + (*number of parameters* * 3.5) | | |
| | REAL | 21.7 + (*number of parameters* * 3.6) | 21.9 + (*number of parameters* * 3.5) | | |
| LBL | na | 0.26 | 0.19 | | |
| LEQ | DINT | 0.40 | 0.39 | 0.11 | |
| | REAL | 0.63 | 0.62 | 0.11 | |
| LES | DINT | 0.40 | 0.39 | 0.10 | |
| | REAL | 0.63 | 0.62 | 0.11 | |
| LFL | SINT | 10.4 | 10.32 | | |
| | INT | 11.6 | 11.45 | | |
| | DINT | 10.8 | 10.71 | 7.5 | |
| | REAL | 10.9 | 10.72 | 7.5 | |
| LFU | SINT | 12.9 | 12.69 | | |
| | INT | 14.3 | 14.15 | | |
| | DINT, REAL | 15.1 | 14.94 | 7.6 | |
| LIM | DINT | 0.85 | 0.85 | 0.11 | |
| | REAL | 3.8 | 3.7 | 0.11 | |
| LN | REAL | 204.8 | 202.3 | 0.10 | |
| LOG | REAL | 205.3 | 202.7 | 0.11 | |
| MCR | na | 0.05 | 0.06 | 0.05 | |
| MEQ | DINT | 0.63 | 0.62 | 0.10 | |
| MOD | DINT | 21.6 | 21.3 | 0.22 | |
| | REAL | 68.1 | 67.2 | 0.20 | |

**Table 4.B Instruction Execution Times (Continued)**

| Instruction: | Optimal Data Type: | True Time (μs): | | False Time (μs): | Notes: |
|---|---|---|---|---|---|
| | | CompactLogix 5320 with RSLogix 5000 Version 7 | CompactLogix 5330 with RSLogix 5000 Version 8 | | |
| MOV | DINT | 0.48 | 0.48 | 0.11 | |
| | REAL | 0.88 | 0.87 | 0.10 | |
| MSG | MESSAGE | 98.0 | | 7.0 | |
| MUL | DINT | 10.2 | 10.0 | 0.11 | |
| | REAL | 19.1 | 18.9 | 0.11 | |
| MVM | DINT | 9.5 | 9.4 | 0.16 | |
| NEG | DINT | 0.60 | 0.59 | 0.11 | |
| | REAL | 1.0 | 0.99 | 0.11 | |
| NEQ | DINT | 0.40 | 0.39 | 0.10 | |
| | REAL | 0.41 | 0.39 | 0.11 | |
| NOP | na | 0.05 | 0.05 | 0.06 | |
| NOT | DINT | 0.57 | 0.56 | 0.11 | |
| ONS | BOOL | 2.97 | 2.93 | 2.7 | |
| OR | DINT | 0.64 | 0.62 | 0.11 | |
| OSF | BOOL | 3.63 | 3.58 | 4.0 | |
| OSR | BOOL | 3.91 | 3.86 | 3.5 | |
| OTE | BOOL | 0.20 | 0.20 | 0.19 | |
| OTL | BOOL | 0.20 | 0.19 | 0.05 | |
| OTU | BOOL | 0.20 | 0.20 | 0.05 | |
| PID | PID | | | 18.4 | |
| Independent | | 378.4 | 373.7 | | |
| ISA-dependent | | 451.7 | 446.1 | | |
| Manual mode | | 330.2 | 326.1 | | |
| Set output mode | | 330.2 | 326.1 | | |
| Independent - slave mode | | 402.0 | 397.0 | | |
| RAD | REAL | 19.6 | 19.3 | 0.10 | |
| RES | CONTROL, COUNTER, or TIMER | 0.34 | 0.34 | 0.21 | |
| RET (in FOR loop) | na | 4.9 | 4.8 | | |
| RTO | TIMER | 0.46 | 0.45 | 0.31 | |

**Table 4.B Instruction Execution Times (Continued)**

| Instruction: | Optimal Data Type: | True Time (µs): | | False Time (µs): | Notes: |
|---|---|---|---|---|---|
| | | CompactLogix 5320 with RSLogix 5000 Version 7 | CompactLogix 5330 with RSLogix 5000 Version 8 | | |
| SIN | REAL | 243.3 | 240.3 | 0.09 | |
| SQI | DINT | 3.8 | 3.8 | 0.16 | |
| SQL | DINT | 6.6 | 6.4 | 3.9 | |
| SQO | DINT | 6.6 | 6.5 | 3.8 | |
| SQR | DINT | 10.5 | 10.4 | 0.10 | |
| | REAL | 39.8 | 39.3 | 0.11 | |
| SRT | DINT | 32.4 + x | 31.9 | 4.6 | Time "x" varies with the length and randomness of the numbers. |
| | REAL | 33.3 + x | 32.8 | 4.3 | |
| SSV | na | See Table 4.D on page D-11 | | 0.15 | |
| STD | SINT | 113.3 + (Length * 55.1) | 111.7 + (Length * 54.4) | 22.0 | |
| | INT | 120.2 + (Length * 55.7) | 118.7 + (Length * 55.0) | 25.3 | |
| | DINT | 120.3 + (Length * 54.6) | 118.4 + (Length * 53.9) | 25.3 | |
| | REAL | 122.2 + (Length * 59.2) | 120.4 + (Length * 58.5) | 25.4 | |
| SUB | DINT | 0.60 | 0.59 | 0.10 | |
| | REAL | 11.3 | 11.2 | 0.11 | |
| TAN | REAL | 307.7 | 303.9 | 0.08 | |
| TND | na | 0.01 | 0.01 | 0.11 | |
| TOD | na | 15.9 | | 0.10 | |
| TOF | TIMER | 0.34 | 0.34 | 0.42 | |
| TON | TIMER | 0.46 | 0.45 | 0.34 | |
| TRN | DINT | 13.9 | 13.7 | 0.21 | |
| | REAL | 22.5 | 22.3 | 0.21 | |
| UID | na | 35.3 | 29.21 | 2.6 | |
| UIE | na | 38.0 | 31.08 | 2.6 | |
| XIC | BOOL | 0.11 | 0.11 | 0.05 | |
| XIO | BOOL | 0.12 | 0.12 | 0.05 | |
| XOR | DINT | 0.64 | 0.62 | 0.11 | |
| XPY | REAL | 530.3 | 517.24 | 0.10 | True time could range from 200 - 400 µs, depending on the values of the operands. |

**Table 4.C Execution Times for the GSV Instruction**

| Object: | Attribute: | True Time (μs): |
|---|---|---|
| PROCESSOR | TimeSlice | 16.9 |
| PROCESSORDEVICE | DeviceName | 55.2 |
| PROCESSORDEVICE | ProductCode | 15.4 |
| PROCESSORDEVICE | ProductRev | 15.4 |
| PROCESSORDEVICE | SerialNumber | 16.3 |
| PROCESSORDEVICE | Status | 15.4 |
| PROCESSORDEVICE | Type | 15.4 |
| PROCESSORDEVICE | Vendor | 15.4 |
| CST | CurrentStatus | 14.4 |
| CST | CurrentValue | 28.2 |
| DF1 | ACTTimeout | 16.5 |
| DF1 | DiagnosticCounters | 67.2 |
| DF1 | DuplicationDetect | 14.9 |
| DF1 | EmbeddedResponseEnable | 14.9 |
| DF1 | ENQTransmitLimit | 14.9 |
| DF1 | EOTSuppression | 14.9 |
| DF1 | ErrorDetection | 14.9 |
| DF1 | MasterMessageTransmit | 14.9 |
| DF1 | NAKReceiveLimit | 14.9 |
| DF1 | NormalPollGroupSize | 15.7 |
| DF1 | PollingMode | 14.9 |
| DF1 | ReplyMessageWait | 16.5 |
| DF1 | StationAddress | 15.7 |
| DF1 | SlavePollTimeout | 16.5 |
| DF1 | TransmitRetries | 14.9 |
| FAULTLOG | MajorEvents | 16.7 |
| FAULTLOG | MinorEvents | 16.7 |
| FAULTLOG | MajorFaultBits | 17.5 |
| FAULTLOG | MinorFaultBits | 17.5 |
| MESSAGE | ConnectionPath | 53.1 |
| MESSAGE | ConnectionRate | 17.4 |
| MESSAGE | MessageType | 15.7 |
| MESSAGE | Port | 15.7 |
| MESSAGE | TimeoutMultiplier | 15.7 |

**Table 4.C Execution Times for the GSV Instruction (Continued)**

| Object: | Attribute: | True Time (μs): |
|---|---|---|
| MESSAGE | UnconnectedTimeout | 17.4 |
| MODULE | EntryStatus | 16.7 |
| MODULE | FaultCode | 16.7 |
| MODULE | FaultInfo | 17.6 |
| MODULE | ForceStatus | 144.5 |
| MODULE | Instance | 17.8 |
| MODULE | Mode | 16.7 |
| MODULE | LEDStatus | 17.2 |
| PROGRAM | DisableFlag | 16.4 |
| PROGRAM | Instance | 17.8 |
| PROGRAM | LastScanTime | 17.6 |
| PROGRAM | MajorFaultRecord | 59.0 |
| PROGRAM | MaxScanTime | 17.6 |
| PROGRAM | MinorFaultRecord | 59.0 |
| PROGRAM | SFCRestart | 16.7 |
| ROUTINE | Instance | 16.8 |
| SERIALPORT | BaudRate | 16.7 |
| SERIALPORT | DataBits | 15.0 |
| SERIALPORT | Parity | 15.0 |
| SERIALPORT | RTSOffDelay | 15.8 |
| SERIALPORT | RTSSendDelay | 15.8 |
| SERIALPORT | StopBits | 15.0 |
| TASK | Instance | 17.7 |
| TASK | LastScanTime | 17.5 |
| TASK | MaxInterval | 21.6 |
| TASK | MaxScanTime | 17.4 |
| TASK | MinInterval | 21.6 |
| TASK | Priority | 16.6 |
| TASK | Rate | 17.4 |
| TASK | StartTime | 21.6 |
| TASK | Watchdog | 17.4 |
| WALLCLOCKTIME | CSTOffset | 21.2 |
| WALLCLOCKTIME | CurrentValue | 37.6 |
| WALLCLOCKTIME | DateTime | 59.8 |

**Table 4.D Execution Times for the SSV Instruction**

| Object: | Attribute: | True Time (μs): |
|---|---|---|
| PROCESSOR | TimeSlice | 35.9 |
| DF1 | PendingACKTimeout | 109.4 |
| DF1 | PendingDuplicateDetection | 108.3 |
| DF1 | PendingEmbeddedResponseEnable | 108.7 |
| DF1 | PendingENQTransmitLimit | 108.3 |
| DF1 | PendingEOTSuppression | 108.2 |
| DF1 | PendingErrorDetection | 108.9 |
| DF1 | PendingNormalPollGroupSize | 108.9 |
| DF1 | PendingMasterMessageTransmit | 108.7 |
| DF1 | PendingNAKReceiveLimit | 108.3 |
| DF1 | PendingPollingMode | 108.7 |
| DF1 | PendingReplyMessageWait | 109.4 |
| DF1 | PendingStationAddress | 109.1 |
| DF1 | PendingSlavePollTimeout | 109.4 |
| DF1 | PendingTransmitRetries | 108.3 |
| FAULTLOG | MajorEvents | 17.0 |
| FAULTLOG | MinorEvents | 17.0 |
| FAULTLOG | MajorFaultBits | 17.4 |
| FAULTLOG | MinorFaultBits | 17.4 |
| MESSAGE | ConnectionPath | 36.9 |
| MESSAGE | ConnectionRate | 32.3 |
| MESSAGE | MessageType | 69.9 |
| MESSAGE | Port | 31.6 |
| MESSAGE | TimeoutMultiplier | 31.7 |
| MESSAGE | UnconnectedTimeout | 32.3 |
| MODULE | Mode | 28.4 |
| PROGRAM | DisableFlag | 37.3 |
| PROGRAM | LastScanTime | 17.5 |
| PROGRAM | MajorFaultRecord | 48.8 |
| PROGRAM | MaxScanTime | 17.5 |
| PROGRAM | MinorFaultRecord | 48.8 |
| PROGRAM | SFCRestart | 33.0 |
| SERIALPORT | PendingBaudRate | 108.5 |
| SERIALPORT | PendingDataBits | 106.7 |

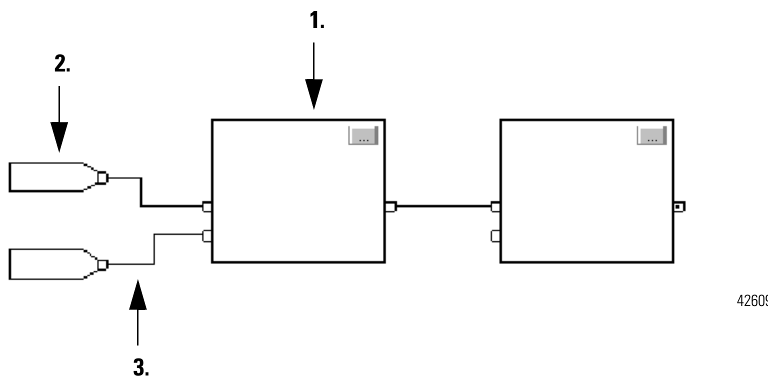
**Table 4.D Execution Times for the SSV Instruction (Continued)**

| Object: | Attribute: | True Time (μs): |
|---|---|---|
| SERIALPORT | PendingParity | 106.6 |
| SERIALPORT | PendingRTSOffDelay | 106.8 |
| SERIALPORT | PendingRTSSendDelay | 107.4 |
| SERIALPORT | PendingStopBits | 106.7 |
| TASK | LastScanTime | 17.7 |
| TASK | MaxInterval | 24.6 |
| TASK | MaxScanTime | 17.7 |
| TASK | MinInterval | 24.6 |
| TASK | StartTime | 24.6 |
| TASK | Watchdog | 33.8 |
| WALLCLOCKTIME | CSTOffset | 2149.4 |
| WALLCLOCKTIME | CurrentValue | 70.5 |
| WALLCLOCKTIME | DateTime | 120.0 |

**Table 4.E Array Index Times**

| For a tag in the subscript of a: | Add (μs): |
|---|---|
| one dimension array | 1.5 |
| two dimension array | 25.5 |
| three dimension array | 30.3 |

## Estimate Execution Time of a Function Block Routine




1. For each function block instruction, add the time from Table 4.F on page D-14.

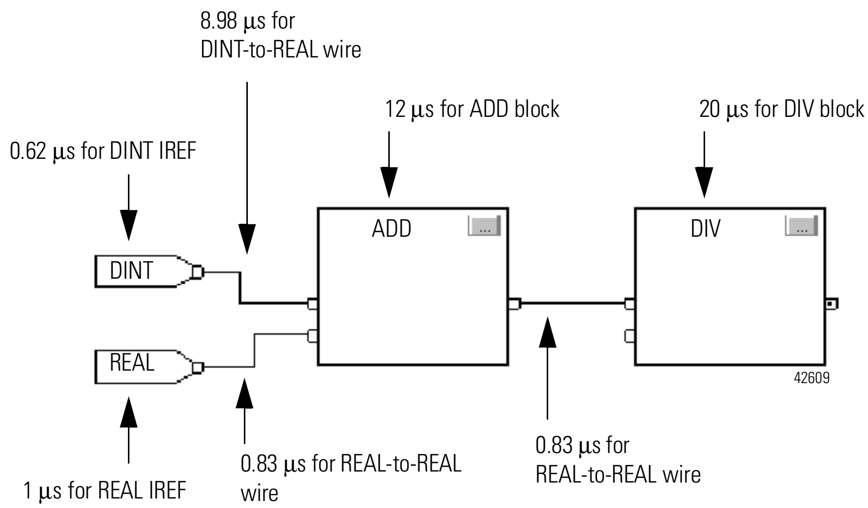
2. For each IREF and OREF, add the following time. (Skip any immediate values.)

| For an: | With a data type of: | Add (µs): | |
|---|---|---|---|
| | | CompactLogix 5320 with RSLogix 5000 Version 7 | CompactLogix 5330 with RSLogix 5000 Version 8 |
| IREF | BOOL | 0.60 | 0.59 |
| | DINT | 0.66 | 0.65 |
| | REAL | 1.05 | 1.04 |
| OREF | BOOL | 0.17 | 0.17 |
| | DINT | 0.17 | 0.17 |
| | REAL | 0.17 | 0.17 |

3. For each wire, add the following time:

| If the wire connects a: | Add (µs): | |
|---|---|---|
| | CompactLogix 5320 with RSLogix 5000 Version 7 | CompactLogix 5330 with RSLogix 5000 Version 8 |
| BOOL-to-BOOL | 0.43 | 0.42 |
| DINT-to-DINT | 0.48 | 0.48 |
| DINT-to-REAL | 9.54 | 9.42 |
| REAL-to-DINT | 14.08 | 13.90 |
| REAL-to-REAL | 0.88 | 0.88 |

**EXAMPLE** Estimate the execution time of a function block routine:




For each function block instruction, add the following time:

**Table 4.F Execution Times for Function Block Instructions**

| Instruction: | Time (µs): | | Notes: |
|---|---|---|---|
| | **CompactLogix 5320 with RSLogix 5000 Version 7** | **CompactLogix 5330 with RSLogix 5000 Version 8** | |
| ABS | 2 | 2 | |
| ACS | 290 | 287 | |
| ADD | 12 | 12 | |
| ALM | 98 | 97 | |
| AND | 1 | 1 | |
| ASN | 280 | 277 | |
| ATN | 239 | 236 | |
| BAND | 10 | 9 | |
| BNOT | 9 | 7 | |
| BOR | 12 | 7 | |
| BTDT | 14 | 12 | |
| BXOR | 10 | 8 | |
| COS | 237 | 234 | |
| CTUD | 16 | 16 | |
| D2SD | 75 | 74 | |
| D3SD | 91 | 89 | |

**Table 4.F Execution Times for Function Block Instructions**

| Instruction: | Time (μs): | | Notes: |
|---|---|---|---|
| | **CompactLogix 5320 with RSLogix 5000 Version 7** | **CompactLogix 5330 with RSLogix 5000 Version 8** | |
| DEDT | 102 | 97 | |
| DEG | 21 | 21 | |
| DERV | 91 | 86 | |
| DFF | 14 | 11 | |
| DIV | 21 | 21 | |
| EQU | 2 | 2 | |
| ESEL-Average Sel. | 87 | 83 | |
| ESEL-High Select | 67 | 67 | |
| ESEL-Low Select | 76 | 76 | |
| ESEL-Manual | 34 | 33 | |
| ESEL-Median Sel. | 124 | 121 | |
| FGEN | 133 | 131 | |
| FRD | 10 | 10 | |
| GEQ | 2 | 2 | |
| GRT | 2 | 2 | |
| HLL | 26 | 25 | |
| HPF | 249 | 246 | |
| INTG | 103 | 105 | |
| JKFF | 14 | 10 | |
| LDL2 | 223 | 225 | |
| LDLG | 173 | 175 | |
| LEQ | 2 | 2 | |
| LES | 2 | 2 | |
| LIM | 5 | 5 | |
| LN | 206 | 203 | |
| LOG | 206 | 204 | |
| LPF | 252 | 242 | |
| MAVE (uniform) | $68 + (x * 17)$ | $72 + (x * 17)$ | $x$ = number of samples |
| MAVE (weighted) | $40 + (x * 11)$ | $38 + (x * 11)$ | $x$ = number of samples |
| MAXC | 22 | 24 | |
| MEQ | 2 | 2 | |
| MINC | 24 | 25 | |
| MOD | 69 | 68 | |
| MSTD | $165 + (x * 51)$ | $159 + (x * 50)$ | $x$ = number of samples |

**Table 4.F Execution Times for Function Block Instructions**

| Instruction: | Time (μs): | | Notes: |
|---|---|---|---|
| | **CompactLogix 5320 with RSLogix 5000 Version 7** | **CompactLogix 5330 with RSLogix 5000 Version 8** | |
| MUL | 20 | 20 | |
| MUX | 21 | 21 | |
| MVMT | 13 | 11 | |
| NEG | 2 | 2 | |
| NEQ | 2 | 2 | |
| NOT | 1 | 1 | |
| NTCH | 310 | 299 | |
| OR | 1 | 1 | |
| OSFI | 12 | 10 | |
| OSRI | 13 | 10 | |
| PI | 141 | 152 | |
| PIDE | 511 | 505 | |
| PMUL | 137 | 134 | |
| POSP | 119 | 96 | |
| RAD | 21 | 20 | |
| RESD | 12 | 11 | |
| RLIM | 94 | 84 | |
| RMPS | 153 | 147 | |
| RTOR | 40 | 38 | |
| SCL | 58 | 57 | |
| SCRV | 265 | 269 | |
| SEL | 15 | 14 | |
| SETD | 11 | 12 | |
| SIN | 244 | 241 | |
| SNEG | 18 | 18 | |
| SOC | 180 | 188 | |
| SQR | 41 | 40 | |
| SRTP | 148 | 135 | |
| SSUM | $35 + (x * 31)$ | $36 + (x * 30)$ | $x$ = number of inputs |
| SUB | 12 | 12 | |
| TAN | 308 | 305 | |
| TOD | 17 | 16 | |
| TOFR | 34 | 35 | |
| TONR | 39 | 44 | |

**Table 4.F Execution Times for Function Block Instructions**

| Instruction: | Time (µs): | | Notes: |
|---|---|---|---|
| | **CompactLogix 5320 with RSLogix 5000 Version 7** | **CompactLogix 5330 with RSLogix 5000 Version 8** | |
| TOT | 115 | 109 | |
| TRN | 15 | 15 | |
| UPDN | 25 | 23 | |
| XOR | 2 | 1 | |
| XPY | 426 | 420 | |

## Calculating I/O Scan Times

Use the following equations to calculate the I/O scan time of your CompactLogix system. Examples showing both the CompactLogix5320 and the CompactLogix 5330 are also provided below. Calculations are based on using RSLogix 5000 programming software, version 8.0

### I/O Scan Time Equations

Input Scan Time (µs) = 90 + (20 x NM) + (0.7 x NI)

Output Scan Time (µs) = 90 + (20 x NM) + (0.4 x NO)

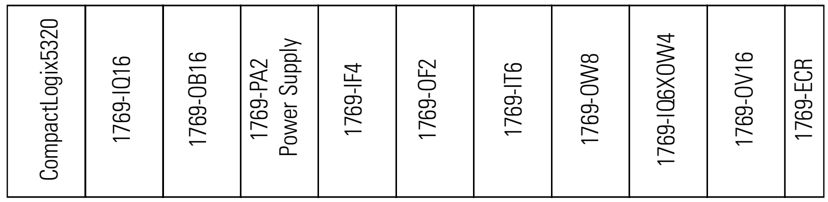
Total I/O Scan Time (µs) = Input Scan Time + Output Scan Time

where:

NM = total number of modules in the system
NI = number of 16-bit input words for the module
NO = number of 16-bit output words for the module

## Example 1 - Estimating I/O Scan Time of a CompactLogix5320 System

This example shows the calculation of the estimated I/O scan time for the following system:




**TIP**

Be sure to calculate the backplane current draw for all I/O modules and the CompactLogix5320 controller. In the example above, the backplane current draw at 5V dc is 1685 mA and at 24V dc is 540 mA. the 1769-PA2 can supply up to 2000 mA at 5V dc and 800 mA at 24V dc.

To calculate I/O throughput, you must know the number of input and output words for each I/O module. You can look up this information in the user documentation for your I/O modules. Or for quick reference, see the table on page H-5 of this manual.

The following table lists the number of input and output words for each module in our Example 1 system.

| I/O Module | Number of Input Words | Number of Output Words |
|---|---|---|
| 1769-IQ16 | 1 | 0 |
| 1769-OB16 | 1 | 1 |
| 1769-IF4 | 6 | 0 |
| 1769-OF2 | 4 | 2 |
| 1769-IT6 | 8 | 0 |
| 1769-OW8 | 1 | 1 |
| 1769-IQ6XOW4 | 2 | 1 |
| 1769-OV16 | 1 | 1 |
| Total | 24 | 6 |

Next, plug these values into the scan time equations to estimate the input and output scan times.

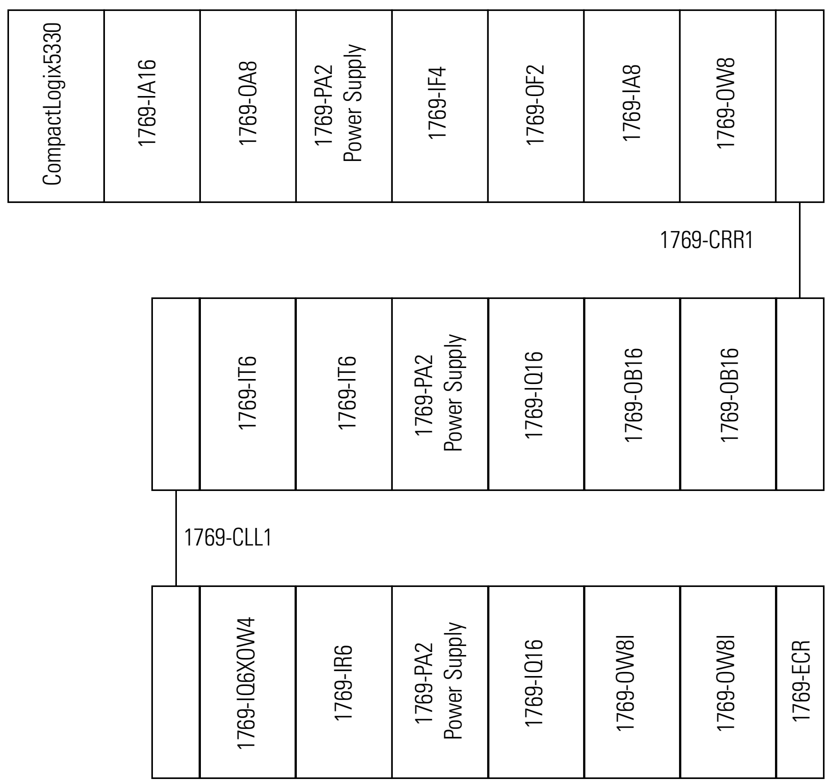
Input Scan Time = 90 + (20 x 8) + (0.7 x 24) = 266.8 µs

Output Scan Time = 90 + (20 x 8) + (0.4 x 6) = 252.4 µs

Total I/O Scan Time = 266.8 µs + 252.4 µs = 519.2 µs

## Example 2 - Estimating I/O Scan Time of a CompactLogix5330 System

This example shows a 3 bank, 16 I/O module system using a CompactLogix5330 controller. This is the maximum number of I/O modules supported by the CompactLogix5330 controller.




**TIP**

Be sure to calculate the backplane current draw for all I/O modules and the CompactLogix5320 controller. In the example above, the backplane current draw is within the capability of the 1769-PA2 power supply in each bank.

To calculate I/O throughput, you must know the number of input and output words for each I/O module. You can look up this information in the user documentation for your I/O modules. Or for quick reference, see the table on page H-5 of this manual.

The following table lists the number of input and output words for each module in our Example 2 system.

| I/O Module | Number of Input Words | Number of Output Words |
|---|---|---|
| 1769-IA8 | 1 | 0 |
| 1769-OA8 | 1 | 1 |
| 1769-IF4 | 6 | 0 |
| 1769-OF2 | 4 | 2 |
| 1769-IA8 | 1 | 0 |
| 1769-OW8 | 1 | 1 |
| 1769-IT6 | 8 | 0 |
| 1769-IT6 | 8 | 0 |
| 1769-IQ16 | 1 | 0 |
| 1769-OB16 | 1 | 1 |
| 1769-OB16 | 1 | 1 |
| 1769-IQ6XOW4 | 2 | 1 |
| 1769-IR6 | 8 | 0 |
| 1769-IQ16 | 1 | 0 |
| 1769-OW8I | 1 | 1 |
| 1769-OW8I | 1 | 1 |
| Total | 46 | 9 |

Next, plug these values into the scan time equations to estimate the input and output scan times.

Input Scan Time = 90 + (20 x 16) + (0.7 x 46) = 442.2 μs

Output Scan Time = 90 + (20 x 16) + (0.4 x 9) = 413.6 μs

Total I/O Scan Time = 442.2 μs + 413.6 μs = 855.8 μs

# Dynamic Memory Allocation in CompactLogix Controllers

Certain operations cause the controller to dynamically allocate and de-allocate user-available memory, affecting the space available for program logic. As these functions become active, memory is allocated. Memory is then de-allocated when these functions become inactive.

The CompactLogix controller dynamically allocates memory for the following:

- Trend Objects
- Trend Drivers
- Connections

Operations that dynamically allocate memory are:

- Messages
- Connection to a Processor with RSLogix 5000
- RSLinx Tag Optimization
- Trends
- DDE/OPC Topics

Although messages are the most likely to cause dynamic memory allocation on a CompactLogix system, all the above operations are discussed in the following sections, along with general guidelines for estimating the amount of memory allocated.

## Messages

Messages can come in and go out of the backplane, or come in and go out of the serial port(s), causing memory allocation as described in the table below. One simple method to reduce the affect that message instructions have on user-available memory is to prevent messages from being sent simultaneously. In general, interlocking messages in this fashion is good practice for peer-to-peer communications on networks such as DH-485 and DeviceNet.

| Type | | Connection Established | Dynamic Memory Allocated |
|---|---|---|---|
| Backplane | Incoming | The message is connected (connection established) | 1200 bytes |
| | | The message is unconnected (no connection established) | 1200 bytes |
| | Outgoing | All outgoing messages whether connected or unconnnected | 1200 bytes |
| Serial Port | Incoming | All incoming messages whether connected or unconnected | 1200 bytes |
| | Outgoing | All outgoing messages whether connected or unconnected | 1200 bytes |

## RSLinx Tag Optimization

Tag optimization creates three items which allocate memory, a trend object, a trend driver, and a connection.

| Item | Description | Memory Allocated |
|---|---|---|
| Trend Object | Created in the controller to group the requested tags. One trend object can handle approximately 100 tags (connection points) | 80 bytes |
| Trend Driver | Created to communicate to the trend object | 36 bytes/single point (some economy for multiple points in a driver) |
| Connection | Created between the controller and RSLinx | 1200 bytes |

**EXAMPLE**

To monitor 100 points:

100 points x 36 bytes = 3600 bytes (Trend Driver)

3600 (Trend Driver) + 80 (Trend Object) + 1200 (Connection)

= approximately 4000 bytes[1]

(1) In general, we estimate that one tag takes about 40 bytes of memory.

## Trends

Each trend created in a controller creates a trend object and allocates a buffer for logging as shown below.

| Item | Memory Allocated |
|---|---|
| Trend Object | 80 bytes |
| Log Buffer | 4000 bytes |

## DDE/OPC Topics

A DDE/OPC Topic uses connections based on the following three variables:

- the number of “Maximum Messaging Connections per PLC” configured in RSLinx
- whether the “Use Connections for Writes to ControlLogix processor” is checked
- the number of connections needed to optimize throughput

**IMPORTANT** These variables are per path. For example, if you set up two different DDE/OPC topics, with different paths to the same controller, the variables limit the connections for each path. Therefore, if you have a limit of 5 connections, it is possible to have 10 connections, with 5 over each path.

### Maximum Messaging Connections per PLC

This variable is configured in RSLinx under the “Communications” menu item “Configure CIP Options”. This number limits the number of read connections made to Logix controllers from a particular workstation.

### Checking “Use Connections for Writes to ControlLogix Processor”

This variable is configured in RSLinx under the “Communications” menu item “Configure CIP Options”. This check box indicates whether

you want RSLinx to open up additional connections for writing data to a Logix controller.

**TIP** There is no way to limit the number of write connections, once this box is checked.

## Number of Connections Needed to Optimize Throughput

RSLinx only opens the number of connections required to optimize throughput. For example, if you have 1 tag on scan, but have configured RSLinx to allow five connections as the maximum number of connections, RSLinx only opens one connection for the tag. Conversely, if you have thousands of tags on scan and limit the maximum number of CIP connections to five, that is the maximum number of connections that RSLinx establishes to the CompactLogix controller. RSLinx then funnels all of the tags through those five available connections.

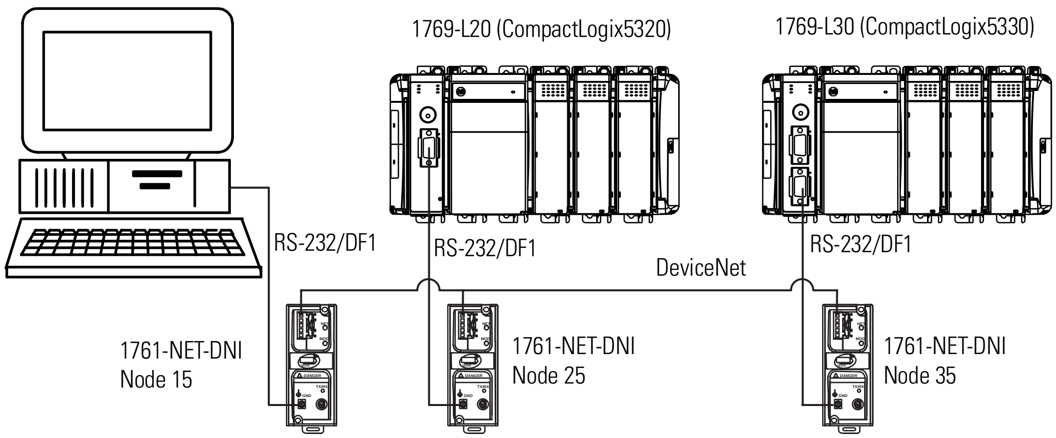
## Viewing the Number of Open Connections

You can see how many connections are made from your workstation to the CompactLogix controller in RSLinx by selecting “CIP Diagnostics” from the “Connections” menu. The Dispatching tab contains various CIP information, including the number of connections open to the CompactLogix controller.

# Communications on DeviceNet

## Using the Serial Port to Connect to a DeviceNet Network

You can use the serial port(s) of the CompactLogix controller to connect to a DeviceNet network using the DeviceNet Interface (DNI), catalog number 1761-NET-DNI. For additional information on using the DNI, refer to the *DeviceNet Interface User Manual*, publication 1761-6.5.




Connecting CompactLogix controllers on DeviceNet requires one 1761-NET-DNI per CompactLogix controller. The DNI converts RS-232 hardware connections and full duplex DF1 protocol to DeviceNet. A computer can also be connected to the DeviceNet network with another 1761-NET-DNI. The Full Duplex DF1 communication driver in RSLinx can be used to allow RSLogix 5000 programming software to upload/download and monitor programs in the CompactLogix controller over the DeviceNet network.

**TIP**

In order to go online using RSLogix5000, you must connect a DNI to the PC's RS-232 port as shown in the system setup above.

The DNI must be commissioned on the DeviceNet network via the RSNetworx for DeviceNet software or the DNI Configuration Utility, version 2.001.

**TIP**

The DNI Configuration Utility, a free tool for commissioning and configuring the DNI, is available for download at **www.ab.com/micrologix**.

Once the DNI is commissioned and all devices on the DeviceNet network have unique node addresses, the CompactLogix controllers can begin exchanging data using MSG Instructions. The Destination Node Address in the DF1 messages sent by the CompactLogix controllers is used by the DNI to route the message to the proper device on DeviceNet.

The following application example shows how to commission the DNI modules on DeviceNet with RSNetworx for DeviceNet software and how to send messages between the CompactLogix controller's serial channels. Refer to the *DeviceNet Interface User Manual*, publication 1761-6.5 for information on the DNI Configuration Utility.

**TIP**

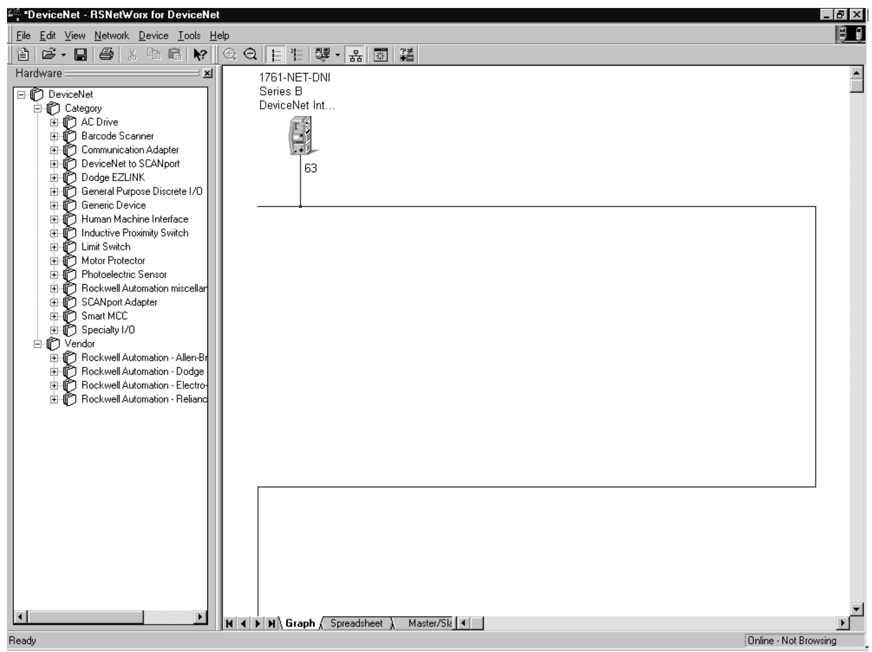
DeviceNet may be preferred over DH-485 because DeviceNet supports data rates up to 500K bits/second and up to 64 nodes, while DH-485 supports data rates up to 19.2 K bits/second and 32 nodes maximum.

## Commissioning the 1761-NET-DNI Modules on DeviceNet

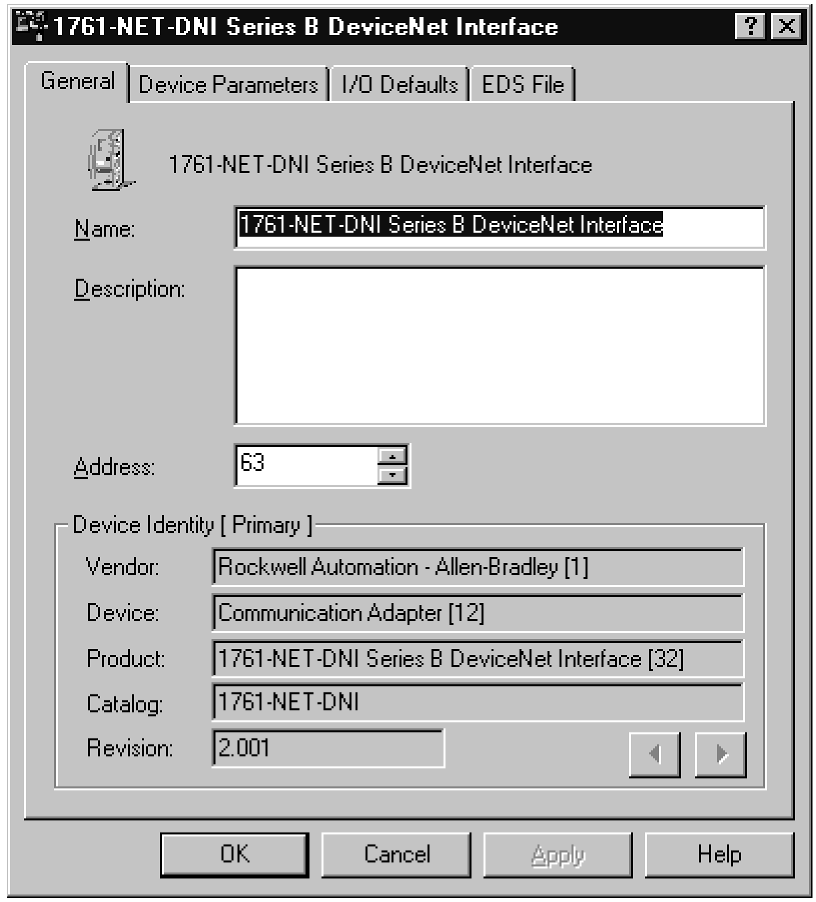
First, commission each DNI module on the DeviceNet network with RSNetworx for DeviceNet. Commissioning is done to assign node addresses to the DNI modules. Each device on the network must have a unique node address. The DNI then routes DF1 messages from each CompactLogix controller to the other CompactLogix controller via DeviceNet and the other DNI module. In this example, after commissioning the DNI modules on the DeviceNet network, we use peer-to-peer messages to send data between CompactLogix controllers.

For a complete description of 1769-NET-DNI features and functionality, refer to the *DeviceNet Interface User Manual*, publication 1761-6.5.

1. Start RSNetworx for DeviceNet by double-clicking its icon. Then connect one of your 1761-NET-DNI modules to the DeviceNet network with your PC. When power is first applied to a DNI, it powers up at node 63. In RSNetworx, click on the online icon or click on the “Network” pull-down menu and select Online. The following screen appears:



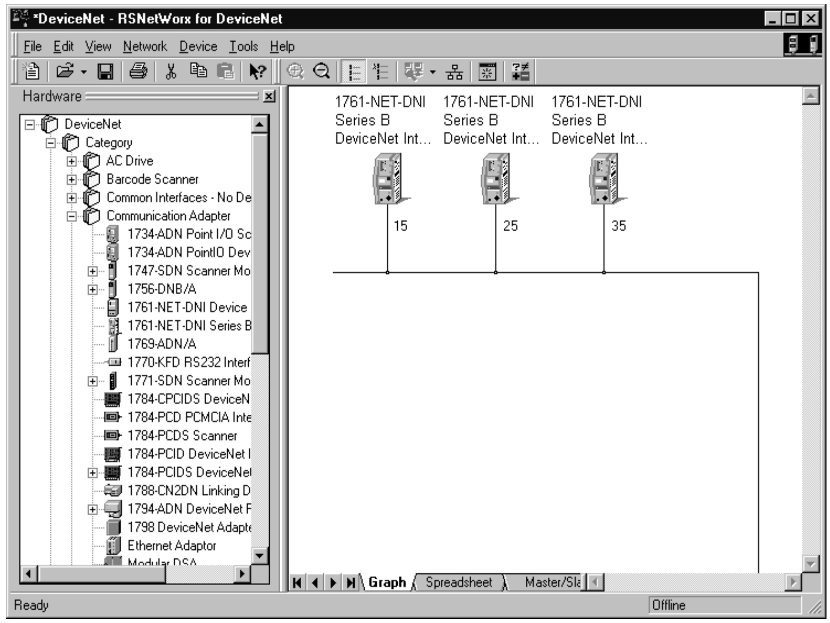
2. The first DNI module appeared as node 63. To change it to any other unique node address, right click on the DNI module and select Properties. The following screen appears:




3. Enter a new node address into the Address field. For this example, addresses 15, 25, and 35 are used for the three DNI module's DeviceNet node addresses. Modify this DNI module's node address to 15. Click Apply and OK.

4. Next, connect the second DNI module to the DeviceNet network. Click the Network pull down menu and select "Single Pass Browse". *The second DNI module should appear at node 63 if the unit is new.* Modify its DeviceNet node address as we did with the first DNI module.

The last two DNI modules should now be at nodes 25 and 35 and the RSNetworx online screen should look like the following:




You have completed the commissioning of your DNI modules with addresses 15, 25, and 35. You can go offline and exit the RSNetworx for DeviceNet software.

## Initializing Messages Between CompactLogix Controllers on DeviceNet

Now that the DNI modules are configured with unique DeviceNet node addresses, we can connect the two CompactLogix controllers to them and develop a short ladder program to read and write data between them with MSG Instructions.

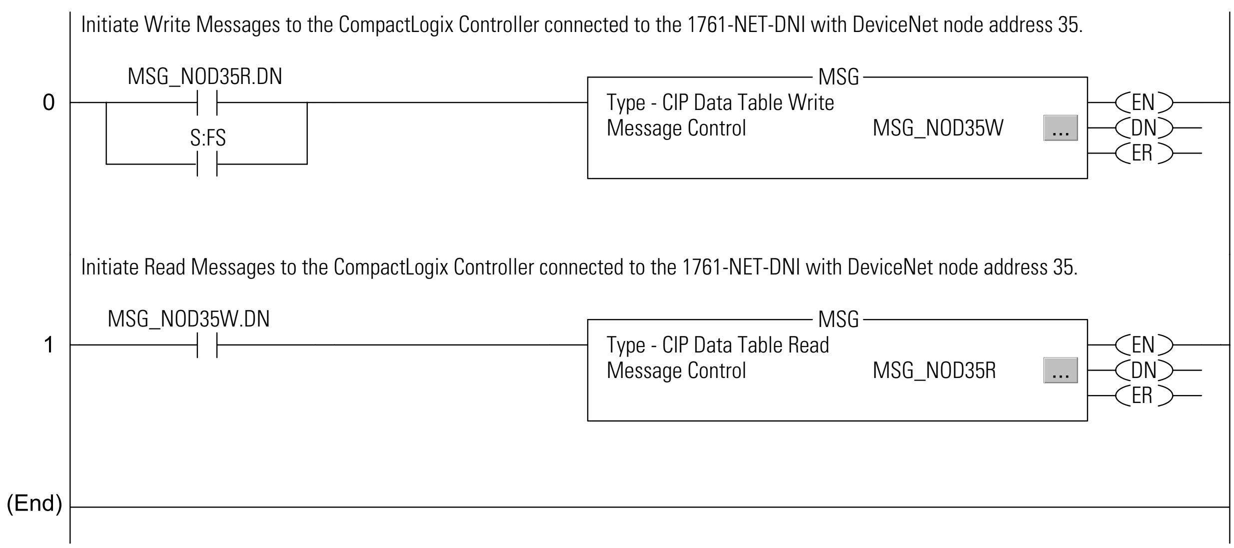
1. Connect the serial channel of each CompactLogix controller to the round mini-din channel on each respective DNI module with a 1761-CBL-PMO2, series B RS-232 or 1761-CBL-AP00 cable.

   For this example, the CompactLogix5320 is connected to DNI node 25, the CompactLogix 5330 to DNI node 35, and the PC to DNI node 15.

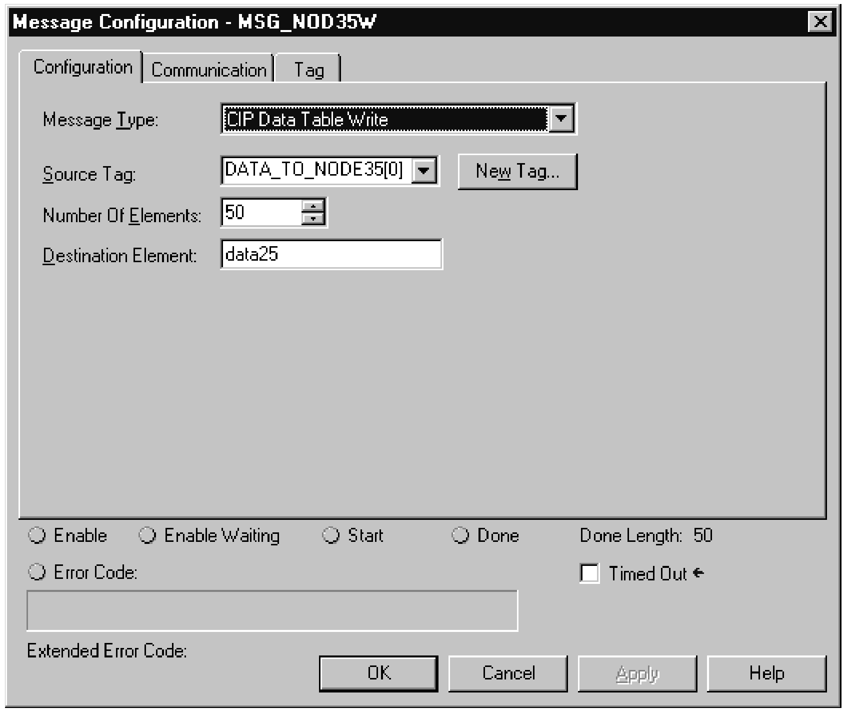
   Assuming that the DNI modules are connected together on the DeviceNet network, any Message sent by either CompactLogix

controller with a destination node address of the other controller's DNI module is automatically routed to the other CompactLogix controller. For example, the CompactLogix5320 controller connected to the DNI module with DeviceNet address 25 must send messages to destination node 35. The message is then routed to the controller connected to the DNI module with DeviceNet node address 35, the CompactLogix 5330 in this case.

2. Start RSLogix 5000 and begin a new project for the CompactLogix5320 controller. Add two ladder rungs, each containing MSG Instructions; one to Write data to the controller and one to Read data from the other controller. For this example, the MSG instructions are executed alternately, initiated at power-up or going to Run mode with the first scan bit (S:FS). This allows each MSG Instruction to intitiate the other MSG Instruction each time it completes. These rungs look like the following:

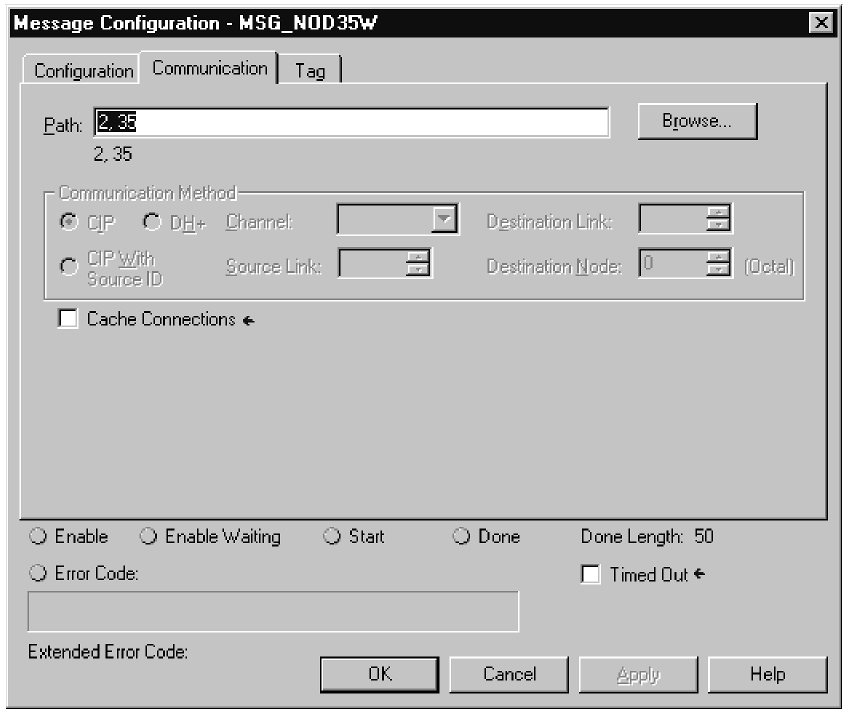


3. The Configuration Tab for the MSG Write Instruction to write fifty 16-bit signed integer data words to the other controller, looks like the following:




A CIP Data Table Write Message Type was used and a 50 integer array tag was created to store the data to write to the other CompactLogix controller. In the controller connected to the DNI node 25, the source tag name for the above Message Instruction is "DATA_TO_NODE35". This indicates that this data is to be sent to the controller connected to DNI node 35. The Destination Element used in this example is a tag name in the CompactLogix5330 controller. For this example, this tag must be an array of at least 50 integer words in length. It is the destination where the data from this MSG Instruction will be sent.

4. The Communication tab for the MSG Instruction looks like the following:




The Path parameter is the only area on this screen that needs to be modified. The Path shown above (2, 35) routes the Message out port 2 (Channel 0) of the local CompactLogix5320 controller and to a destination node address 35. This is the DeviceNet node address of the DNI to which the remote CompactLogix5330 controller is connected. The Cache Connections selection is not valid for serial port communications.

The Tag tab merely shows the tag name for the MSG control block. Click Apply and OK to save your changes.

5. The Read message in rung 1 of the ladder logic on page F-6 is very similar to the Write message. The difference is that for the Read message, the Message Type is “CIP Data Table Read”, the Source is “data 25” and the Destination is a tag in the sending controller called “DATA_FROM_NODE35”, for this example. The “data25” tag, located in the CompactLogix5330 controller, is the data table tag location to which both messages in the CompactLogix5320 controller read and write data.

6. Before saving the project, be sure that the port parameters of the serial port match those of the DNI module's serial port. The default RS-232/Full-duplex DF1 port parameters for the DNI modules and the CompactLogix controllers are identical, except for the error checking method. The DNI module uses the CRC check by default, while the CompactLogix controller's serial port defaults to BCC. For this example, we change this parameter in the CompactLogix controller from BCC to CRC.

   To accomplish this in each CompactLogix controller project, right-click on the controller name (the upper-most parameter in the Controller Organizer) and select properties. Click on the System Protocol tab (for a CompactLogix5320 controller) or System Protocol Ch0 or System Protocol Ch1 (for a CompactLogix5330 controller) and select CRC for the Error Detection. Verify that the DF1 Point-to-Point protocol has been selected. Click on the Serial Port tab to verify that the following default parameters are configured for the serial port. (These parameters match the default parameters of the DNI module's serial port.)

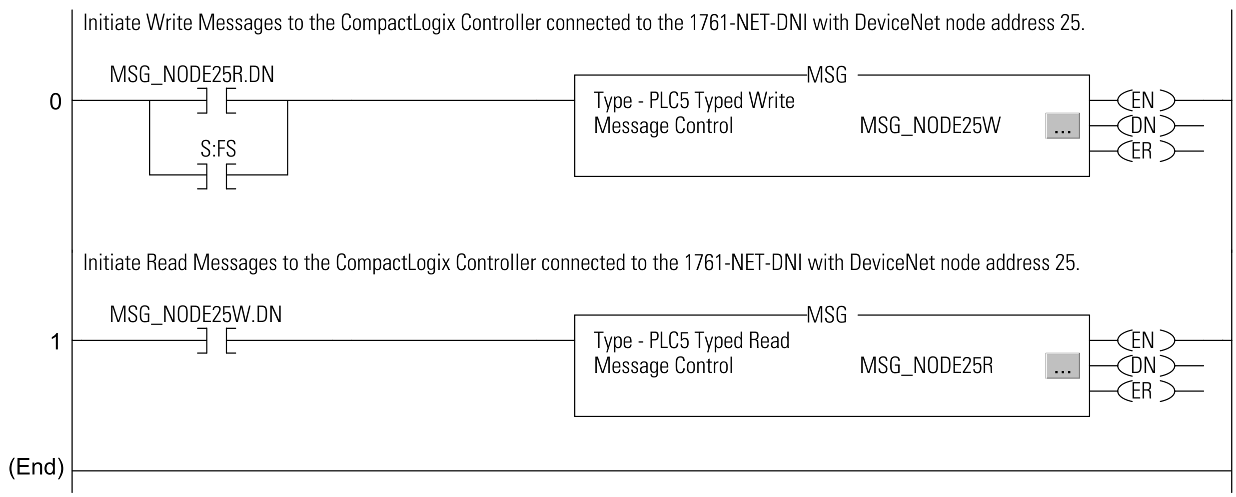
| Parameter | Setting |
|---|---|
| Mode | System |
| Baud Rate | 19200 |
| Data Bits | 8 |
| Parity | None |
| Stop Bits | 1 |
| Control Lines | No Handshaking |

   Click APPLY, then OK to save your port configuration parameters.

7. If you wish to have the CompactLogix5330 controller send read and write messages to the CompactLogix5320 controller, add the same two message rungs to it and be sure to create all necessary tags. For this example, a tag named "data35" was created in the CompactLogix5320 controller. The "data35" tag is an array of 50 integer words so the CompactLogix5330 can read and write to it.

The ladder program in the CompactLogix5330 controller is as follows. The MSG control tags were named to reflect their destination.

**TIP** If using Channel 1 on the CompactLogix5330 controller, this is Port 3 for each MSG instruction's Path.




**8.** Download the two RSLogix 5000 project files to their respective CompactLogix controllers and place the controllers into the RUN mode. Each controller will begin reading and writing data to the other controller via their serial ports, the DNI modules and the DeviceNet network.

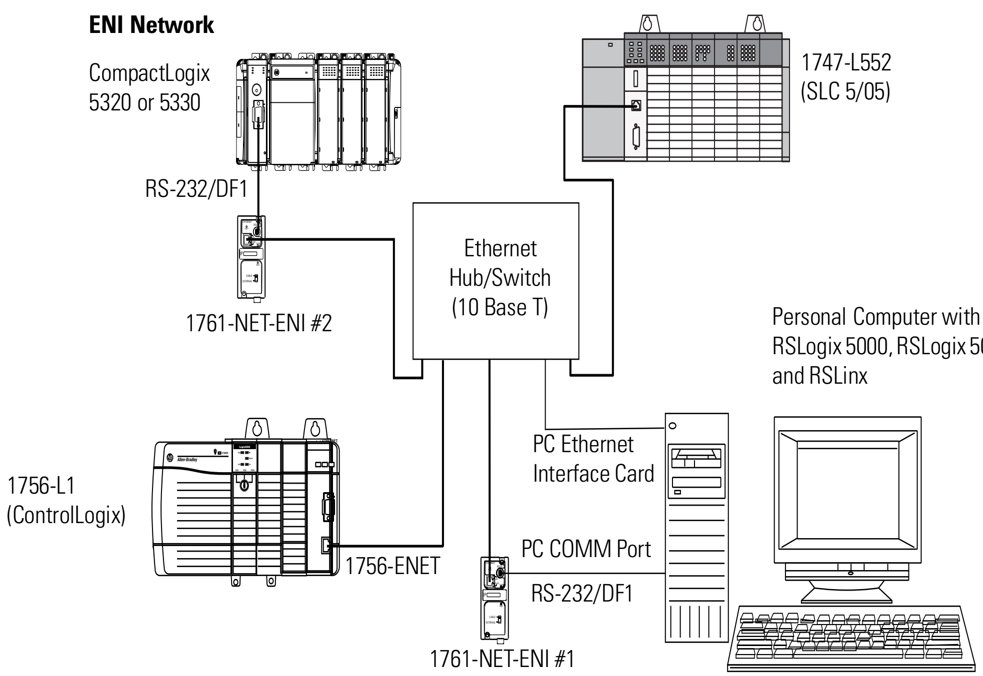
# Communications on Ethernet

This appendix contains an example of using CompactLogix controllers on an Ethernet network, including:

- System Diagram
- Purpose
- Scope
- General Ethernet Information
- Configuring 1761-NET-ENI #1
- Configuring 1761-NET-ENI #2
- Configure RSLinx and Download The Program To The CompactLogix Controller
- Create MSG Programs for the SLC 5/05 and the 5550 Controllers
- Configuring an Ethernet Driver in RSLinx

## System Diagram

**Example Network**



The computer must include the following software:

- RSLogix5000, version 7.00 or later for CompactLogix5320, version 8.00 or later for CompactLogix5330
- RSLinx, version 2.30.00 or later
- RSLogix500
- ENI Configuration Tool

The CompactLogix5320 controller must contain firmware 7.17 or later. The CompactLogix5330 controller must contain firmware 8.14 or later.

The Ethernet Interface Card in the computer is used to connect directly to the SLC 5/05 controller (channel 1) and to the 5550 controller via the 1756-ENET card. The computer COMM Port is used to connect to the CompactLogix controller via the 1761-NET-ENI modules and an Ethernet hub/switch.

| | |
|---|---|
| **IMPORTANT** | In order to go online to a CompactLogix controller using RSLogix5000 , you must connect an ENI to your PC's RS-232 port as shown in the example network on page G-1. The PC's Ethernet card will not work at this time. |

## Purpose

Provide Ethernet connectivity for CompactLogix controllers via the RS-232 serial port and the 1761-NET-ENI module.

## Scope

Connecting CompactLogix controllers on Ethernet requires one 1761-NET-ENI per CompactLogix controller. The ENI converts RS-232 hardware connections and DF1 full-duplex protocol to Ethernet TCP/IP.

The ENI can be configured with IP addresses assigned to node numbers 0 to 49. The Destination Node Address in DF1 messages is then used by the ENI to route these messages to the proper devices on Ethernet.

This application example shows how to configure the ENI module and how to send messages from the CompactLogix controller to the other Controllers on Ethernet. This example also shows how to initiate messages from the Ethernet controllers to the CompactLogix

controller. Messages sent to the ENI module's IP address will be delivered to the serial port of the CompactLogix controller.

**TIP** In the ENI, node addresses 45 through 49 are dedicated for 1756-ENET/ControlLogix controllers. Node addresses 0 through 44 are used for all other Ethernet devices, such as other CompactLogix controllers connected to ENI modules and SLC 5/05 controllers.

## General Ethernet Information

Each Ethernet device requires a unique IP address. If your Ethernet network is isolated from the company-wide network, any valid IP addresses may be used. If your Ethernet hub is connected to a larger Ethernet network, contact your System Administrator for unique IP addresses. For this example, the following IP addresses will be assigned to the various Ethernet devices on our network:

**Table 0.1 Example Network IP Addresses**

| IP Address | Device |
|---|---|
| 131.200.50.92 | SLC 5/05 controller |
| 131.200.50.93 | 1756-ENET |
| 131.200.50.94 | 1761-NET-ENI #2 (1769-L20 or -L30 controller) |
| 131.200.50.95 | 1761-NET-ENI #1 (computer COMM port) |
| 131.200.50.96 | computer's Ethernet card |

The subnet mask for each Ethernet device is 255.255.0.0.

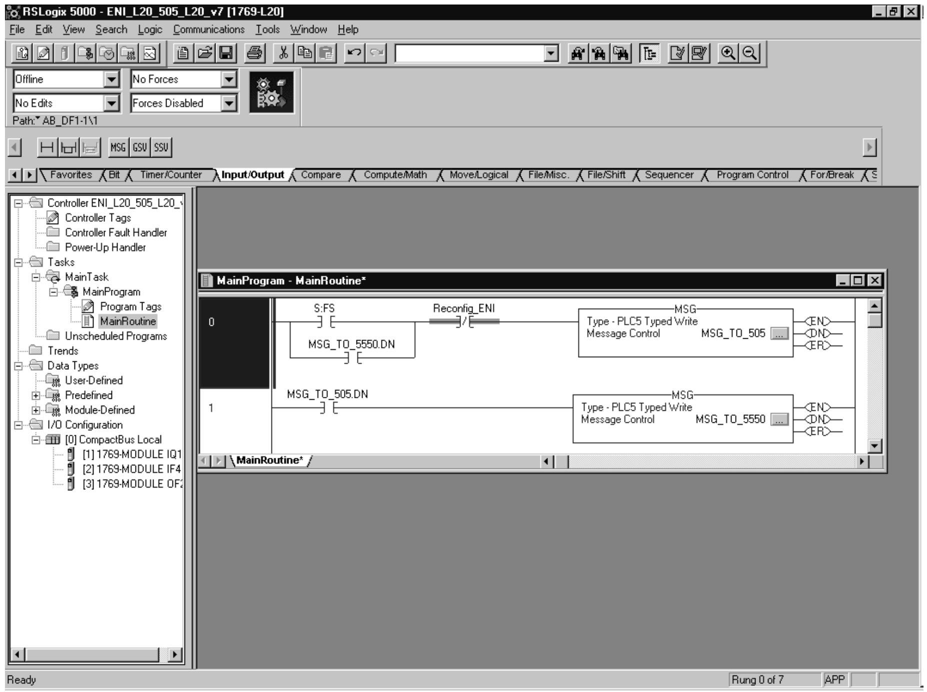
**IMPORTANT** The RS-232/DF1 interface between the CompactLogix controller and its ENI module, and between the computer (RSLogix 5000/RSLinx) and its ENI module, should use 38400 baud. This allows fast upload/download of programs.

When using 38400 baud, the number of Stop Bits in RSLinx and in the CompactLogix controller must be set to 2.

Rungs 0 and 1, shown on page G-4, of the CompactLogix controller's ladder program show an example of throttling two message (MSG) instructions. In this case, sending a MSG to the SLC 5/05, and then when it's done, initiating a MSG to the 1756-ENET/5550 controller and so on. The two MSG Instructions toggle, with only one outstanding MSG at a time. See Appendix E for details.

This is recommended for the CompactLogix controller to keep the amount of user memory needed for incoming and outgoing messages to a minimum. Each message requires approximately 1.1K bytes of user memory, allocated when the message is to be sent or received. If two messages were enabled at the same time, 2.2K bytes of user memory would need to be available.

**Throttling Message Instructions**



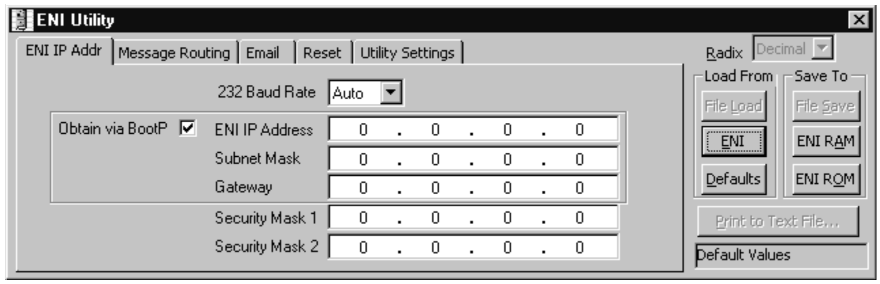

## Configuring 1761-NET-ENI #1

The ENI Configuration Utility is free software designed for configuring the 1761-NET-ENI, available for download from **http://www.ab.com/micrologix**.

The first task is to configure the ENI module that will be connected to the computer. This is ENI #1 as shown on page G-1. A 1761-CBL-PM02 serial cable is used to connect a computer serial communication port to the RS-232 mini-din serial port on the ENI. The ENI Configuration Tool will be used to configure this ENI. Double click the “eniutiCE.exe” icon on your desktop to start the ENI configuration tool.

The following screen should appear:

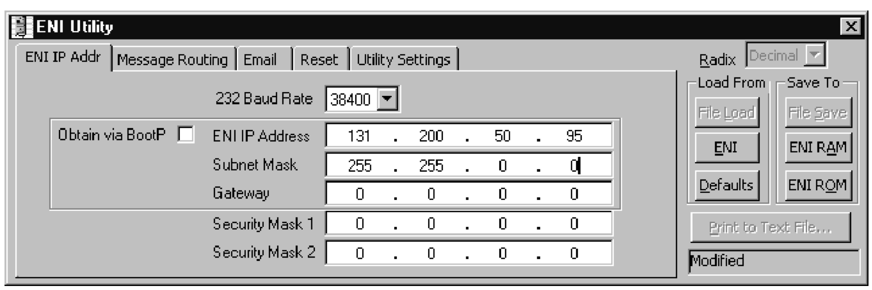
**ENI Configuration Tool ENI IP Addr Screen**



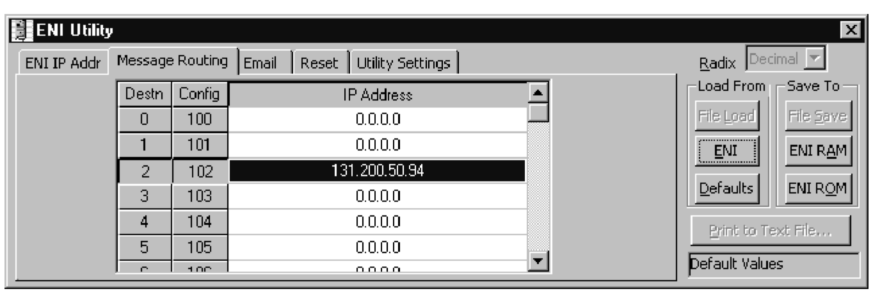

For this example, we will be using 38400 baud on all serial connections. We will also assign IP addresses to all Ethernet products rather than using BOOTP.

Two tabs in the ENI software tool must be modified for the purposes of this example, the "ENI IP Addr" tab and the "Message Routing" tab. The IP address for the ENI connected to the CompactLogix controller (ENI #2) is the only address we need to add to the ENI #1 Message Routing table. The other two Ethernet devices are accessed by the computer via the computer's Ethernet card. Make the two ENI #1 tabs look like the following:

**ENI #1 Configuration - ENI IP Addr Screen**

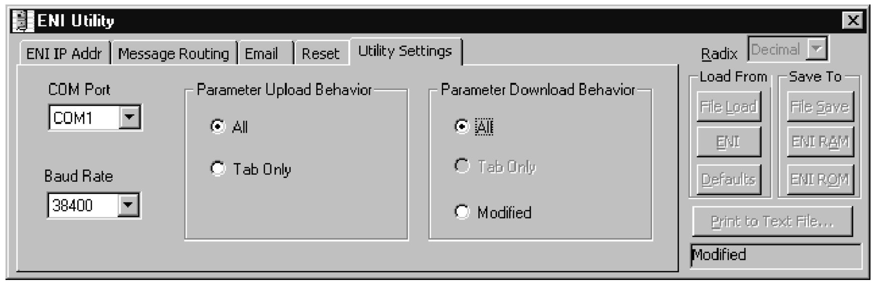



**ENI #1 Configuration - Message Routing Screen**



Before we download our configuration to ENI #1, we must configure the "Utility Settings" tab in the ENI configuration tool. Make this tab look like the following.

**ENI #1 Configuration - Utility Settings Screen**




Then, connect the serial cable between your computer and ENI #1 and click on the ENI IP Addr tab. From this tab, under the "Save To" column, click the ENI ROM button. This will download your configuration parameters to ENI #1 and save it to non-volatile memory.

## Configuring 1761-NET-ENI #2

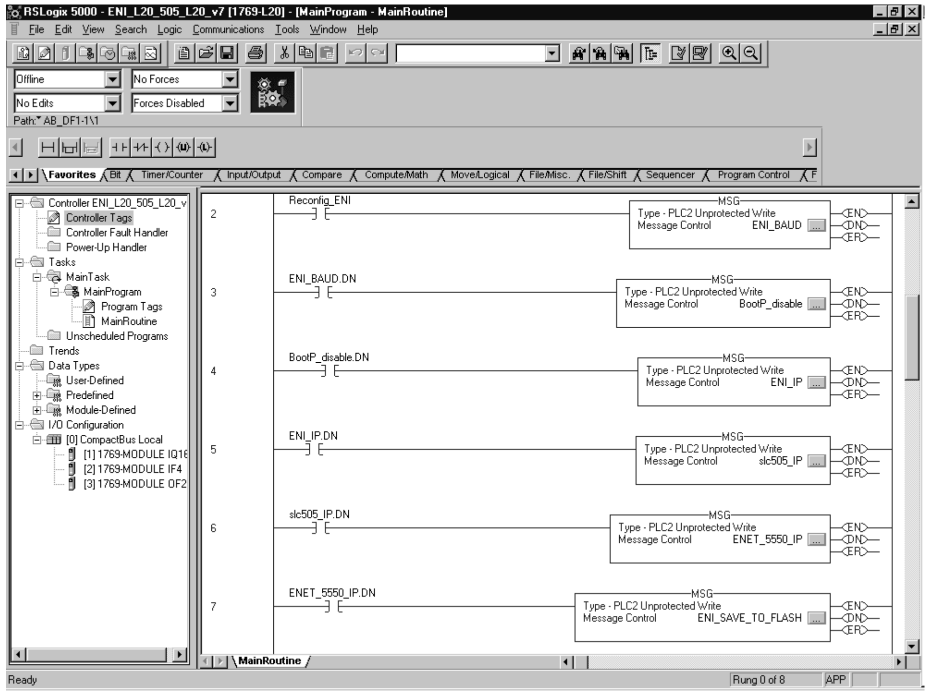
ENI #2 is connected to the CompactLogix controller. This ENI must be configured with its own IP address (131.200.50.94 for this example), and we must add the IP addresses of the SLC 5/05 controller and the 1756-ENET/5550 controller to its Message Routing table. The Message Routing table allows for up to 50 IP addresses to be linked to DF1 destination node addresses, for the following purposes:

**Table 0.2 Message Routing**

| Nodes | Function |
| --- | --- |
| Nodes 0 to 44 | When sending messages to any Ethernet device (other than ControlLogix) that supports the same command set as the CompactLogix controller, i.e. SLC 5/05, PLC-5E and other ENI modules. We will use the PLC-5 Typed Write commands for this example. CIP commands are not supported by the ENI. |
| Nodes 45 to 49 | When sending messages to a 1756-ENET/ControlLogix Controller, the controller **MUST** be in slot 0 of the ControlLogix chassis for the message to be delivered to it. |

At this point we could merely configure ENI #2 as we did ENI #1. Or, we could use a method that sends configuration Messages from the CompactLogix controller via the DF1 link. If for any reason this ENI would need to be replaced, it could then be easily and quickly configured via messages from the CompactLogix controller. A ladder program to accomplish this is as follows:

**ENI #2 Configuration - RSLogix 5000 Ladder Program**



The above ladder rungs, 2 through 7 and the rungs, 0 and 1 shown earlier in this application example, make up the ladder program for the CompactLogix controller. Details of each MSG Instruction will follow.

In the above program, Rung 2 initiates the string of configuration messages with input instruction “Reconfig_ENI”. This could be an alias to an input connected to a pushbutton for example, for quick configuration of the ENI module.

The 5 rungs used to configure ENI #2 are defined as follows:

**Table 0.3 ENI #2 Configuration - Rung Descriptions**

| Rung | Function |
|---|---|
| Rung 2 | This rung initiates the process and configures the ENI module's Serial port for 38400 Baud. |
| Rung 3 | This rung is initiated by the Done bit of the previous MSG and it disables BOOTP. |
| Rung 4 | This rung configures the ENI with its own IP address. |
| Rung 5 | This rung adds the IP address of the SLC 5/05 controller to the ENI module's Message Routing table at DF1 node 1. This means that any message sent by the CompactLogix controller with a DF1 destination address of 1 will be sent to the SLC 5/05 controller on Ethernet. |
| Rung 6 | This rung adds the IP address of the 1756-ENET module to the ENI module's Message Routing table at DF1 node 45. This means that any message sent by the CompactLogix controller with a DF1 destination address of 45 will be sent to the 5550 controller in slot 0, via the 1756-ENET module on Ethernet. |
| Rung 7 | This rung instructs the ENI module to save the configuration data sent to it in non-volatile memory. |

The following table contains the information needed to send messages to the ENI to configure it for this example. For a complete list of ENI configurable features, please refer to the *MicroLogix™ Ethernet Interface (ENI) User Manual*, publication 1761-UM006A-EN-P.

**Table 0.4 ENI #2 Configuration - Message Instructions Parameters**

| Configuration Node Number | Configuration Function | Data Type | Message Node Number | Message Length (bytes) | Message Function |
|---|---|---|---|---|---|
| 101 | Configure Route 1 Address | Integers | 1 | 8 | Route DF1 MSG to IP at Address 1 |
| 145 | Configure Route 45 Address | Integers | 45 | 8 | Route DF1 MSG to IP at Address 2 |
| 248 | Save/Reset | Integer | N/A | 2 | 0 = save configuration to flash |
| 250 | TCP/IP Config. | Integer | N/A | 8 | Assign an IP Address to the ENI |
| 252 | BOOTP | Integer | N/A | 2 | 1 = disable BOOTP |
| 253 | Baud Rate | Integer | N/A | 2 | 6 = 38400 Baud |

For this example, as mentioned earlier, we assign the following IP addresses to the devices on Ethernet:

**Table 0.5 Example IP Addresses for Ethernet Devices**

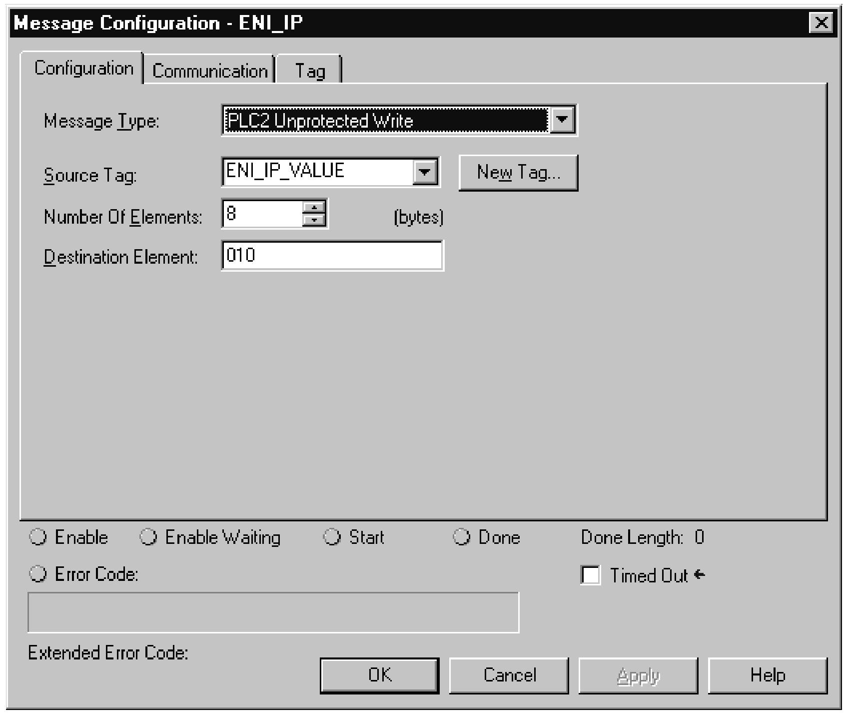
| Device | Node Address (for L20 MSG) | IP Address |
|---|---|---|
| SLC-5/05 | 1 | 131.200.50.92 |
| 1756-ENET | 45 | 131.200.50.93 |
| 1761-NET-ENI #2 | N/A | 131.200.50.94 |
| 1761-NET-ENI #1 | N/A | 131.200.50.95 |
| Computer Ethernet Card | N/A | 131.200.50.96 |

**IMPORTANT** The IP addresses above were arbitrarily assigned for this demonstration and should only be used on an isolated Ethernet network. Contact your system administrator for unique IP addresses if you are connecting your Ethernet devices to your company's Ethernet network.

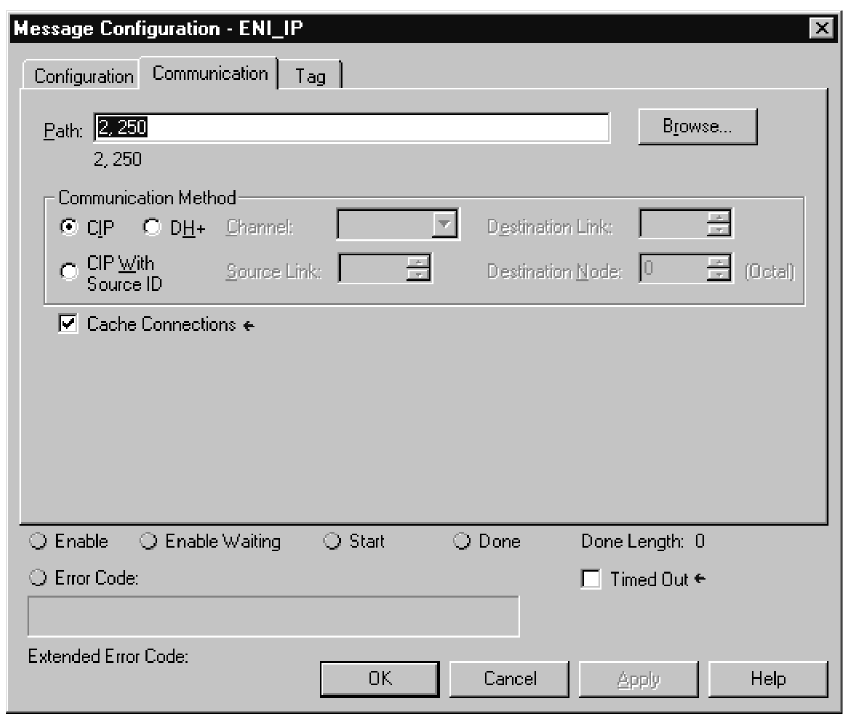
The Message Instructions for the CompactLogix controller, Rungs 2 through 7, used to configure the ENI module, must be "PLC2 Unprotected Write" Message Type. The "Destination Element" can be any valid PLC2 command value. "010" is used in this example because it is the first available valid value. This parameter is not used by the ENI, but must be a valid value for RSLogix 5000 to accept it.

An example of the MSG Configuration tab and the Communication tab for the MSG Instruction used to configure the IP address for the ENI (Rung 4) are as follows:

**ENI #2 Configuration - Message Configuration Tab**




**ENI #2 Configuration - Message Communication Tab**

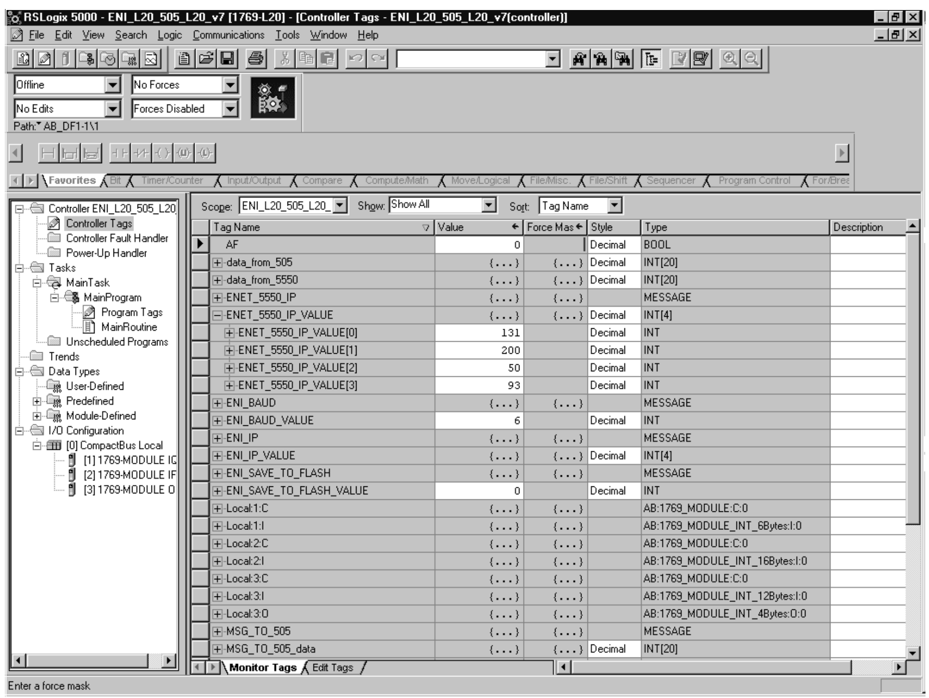


**TIP**

The 2 in the Path shown in the screen above (2,250) directs the MSG to Channel 0 of the CompactLogix controller. Use 3 for Channel 1 of the CompactLogix5330 controller.

The MSG length is 8 bytes or 4 integer words. These 4 words contain the IP address for ENI #2 and are stored in tag ENI_IP_VALUE, which is a tag address containing 4 integer words. This is shown in the CompactLogix controller's tag database shown below. On the MSG Instruction's Communication tab above, the path is "2,250", where the 2 represents the CompactLogix controller's channel 0 serial port and the 250 tells the ENI module that the 4 words of data contain its IP address.

**CompactLogix5320 Controller's Tags**




As indicated in the table on page G-8, the MSGs in Rungs 2, 3 and 7 are 2 bytes or 1 integer word in length. Their Paths are "2,253", "2,252" and "2,248" respectively; where 253 represents Baud Rate, 252 represents BOOTP Enable/Disable, and 248 represents the Save function.

The single integer data values for these messages are shown in the table on page G-8. "0" is the value for the Save MSG data tag (ENI_SAVE_TO_FLASH_VALUE), which instructs the ENI to save its configuration to non-volatile memory. "6" is the value for the Baud Rate MSG data tag (ENI_BAUD_VALUE) which instructs the ENI to

begin communicating on its RS-232 port at 38400 Baud. “1” is the value to disable BOOTP (BootP_disable_value).

As shown in the table on page G-8, the MSGs in Rungs 5 and 6 assign IP addresses to node numbers in the ENI module’s Message Routing Table. These two MSG Instructions are the same as the MSG Instruction in Rung 3, except the paths are 2,101 and 2,145 and the data tags have different names; this time containing the IP addresses of the SLC 5/05 and 1756-ENET module.

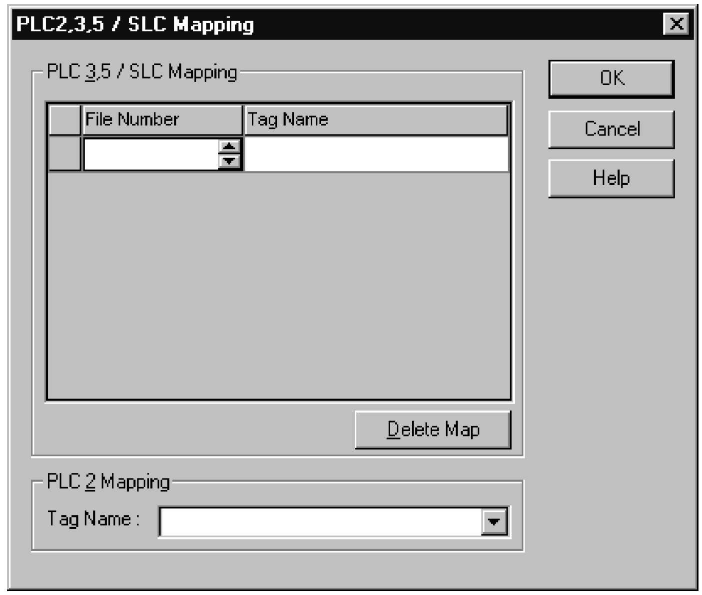
Enter your CompactLogix ladder program for Rungs 0 through 7 as shown and described above. Be sure to enter your IP addresses for ENI #2, the SLC 5/05, and the 1756-ENET into the proper tags in the controller’s tag database. Before saving your program, enter the Controller Properties window by clicking on the Edit pull-down menu and selecting Controller Properties. Click on the System Protocol tab and change Error Detection from BCC to CRC and the Baud Rate from 19200 to 38400. Click APPLY, then OK. The ENI modules use CRC Error Detection. If you do not change this parameter in your CompactLogix controller, it will not be able to communicate with the ENI.

The Baud Rate of 38400 is used to increase the upload/download speed.

Finally, since Logix controllers do not use the structured data table addressing scheme used by PLC and SLC controllers, we must map file numbers used in the commands sent to any Logix controller to tag names within them. For example, a MSG sent by an SLC 5/05 controller to a CompactLogix controller uses a PLC-5 Typed Write command. The target data table address used is N12:0. This file 12 must be mapped to a valid tag name in the CompactLogix controller. Since the MSG is 20 integer words in length, a tag in the CompactLogix controller called “Data_From_505” was created as a 20 integer word tag.

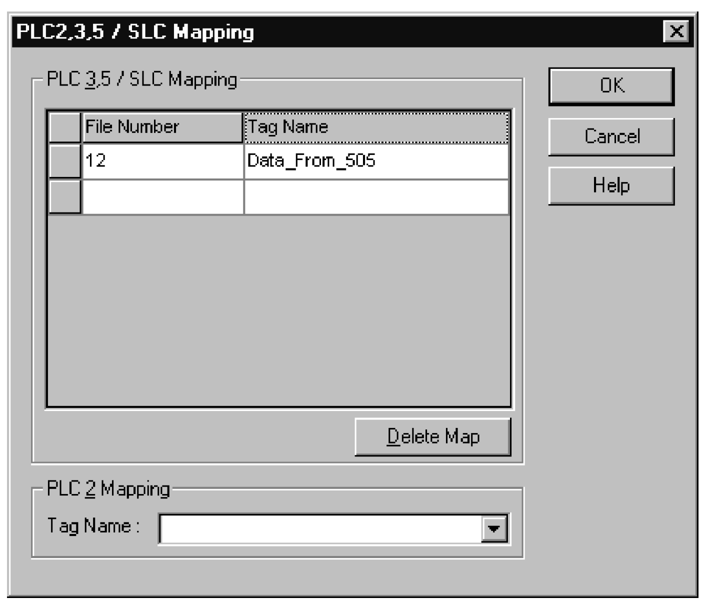
While offline in the CompactLogix controller project, click on the Logic pull-down menu and select “Map PLC/SLC Messages”. The following screen appears:

**File Mapping in RSLogix 5000**




In the File Number column, enter 12. Under the Tag Name, click on the right side in the white box to reveal your Controller Tags and select the tag name you created ("Data_From_505" for this example). More than one entry may be mapped. When finished, your Map PLC/SLC screen for the CompactLogix controller should look like the following:

**File Mapping for the CompactLogix5320 Controller in RSLogix 5000**



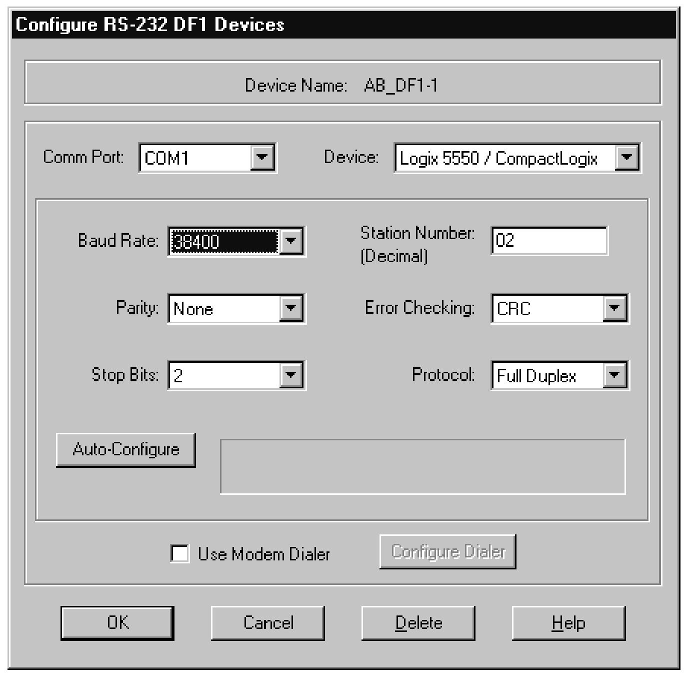

Save your program.

## Configure RSLinx and Download The Program To The CompactLogix Controller

The ladder program written for the CompactLogix controller is downloaded to the controller via the two ENI modules. A full-duplex DF1 driver must be configured in RSLinx to initiate the download to ENI #1.

Start RSLinx. From the “Communication” pull down menu, select “Configure Drivers”. From the Configure Driver screen, click on the arrow next to the “Available Drivers Box” to reveal all RSLinx drivers. Click on “RS232 DF1 devices”, then click on “Add New”. Click OK to the “AB_DF1-1” driver name that appears. The “Configure RS232 DF1 Devices” screen appears. Modify the DF1 parameters on this screen to look like the following:

**Modify DF1 Parameters Using RSLinx**




It is very important that the “Station Number” match the “Destn” number in ENI #1, assigned to the IP address for ENI #2. In this example, we arbitrarily used Destn address 2 to represent IP address 131.200.50.94, which is the IP address of ENI #2.

DO NOT click on the “Auto Configure” button on this screen.

When you have properly modified the parameters on this screen, click OK. Then close the Configure Drivers screen.

Open the WHO Active screen by clicking on the Communications pull-down menu and selecting Who Active. If your system is properly connected, you should be able to click on the + sign left of the

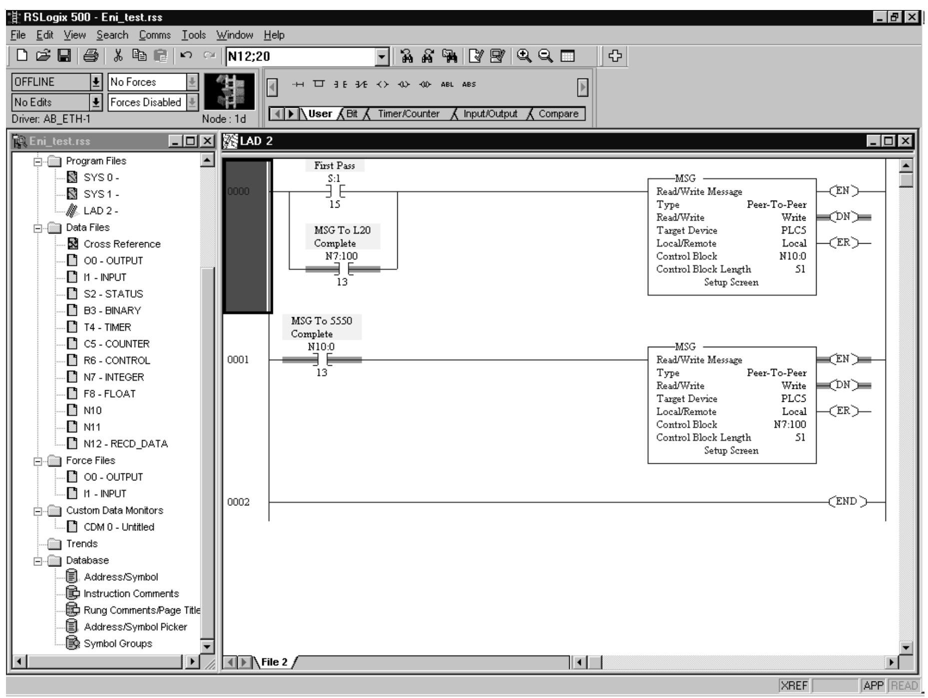
AB_DF1-1 driver you created, and the CompactLogix controller should appear beneath the driver. Minimize, but do not close RSLinx.

Start RSLogix 5000. Open the CompactLogix program created earlier. Click on the Communications pull-down menu and select Who Active. From the Who Active screen, click on the + sign left of “AB_DF1-1, DF1”. The CompactLogix controller should appear. Single-click on it to highlight it, then click Download. Your program should download to the controller. You should be online with the controller when the download is complete.

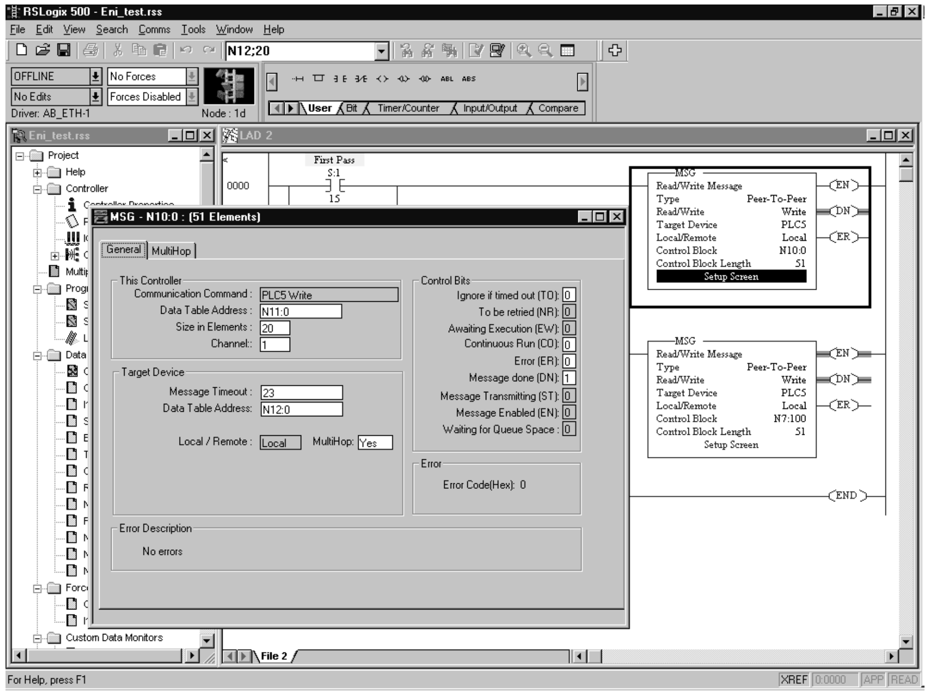
## Create MSG Programs for the SLC 5/05 and the 5550 Controllers

We must now create MSG ladder programs for our other two controllers on Ethernet. The following is the MSG ladder program for the SLC 5/05 controller, developed with RSLogix 500. Following the ladder program are four additional screens showing the two tabs for each MSG Instruction. Before saving your program, be sure to configure Channel 1 with its IP address, subnet mask, and disable BOOTP. Then, save your program.

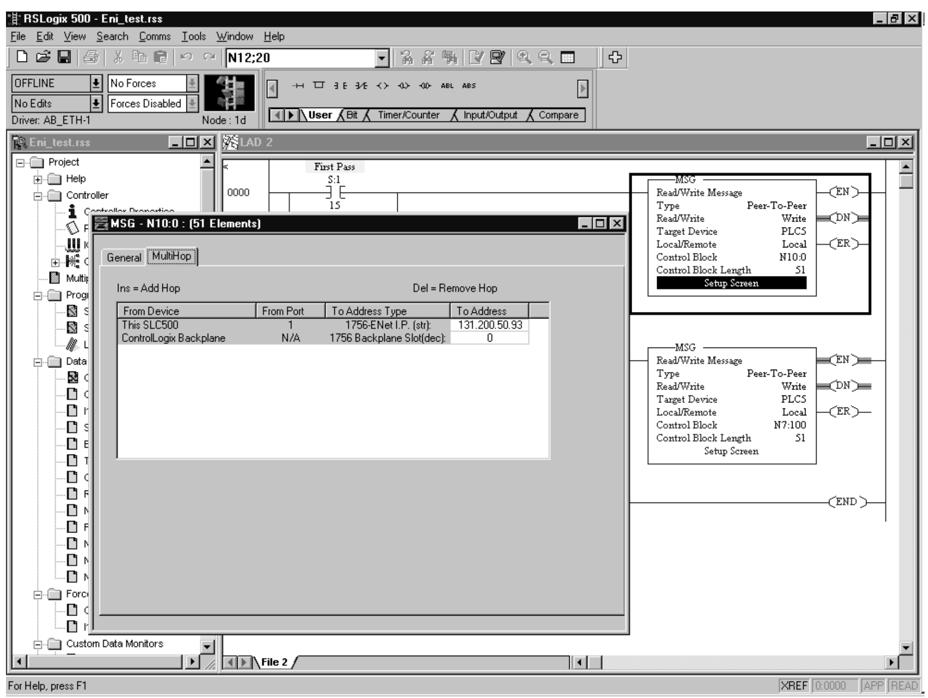
**SLC 5/05 Controller Ladder Program**



**SLC 5/05 Rung 0 MSG "General" Tab**

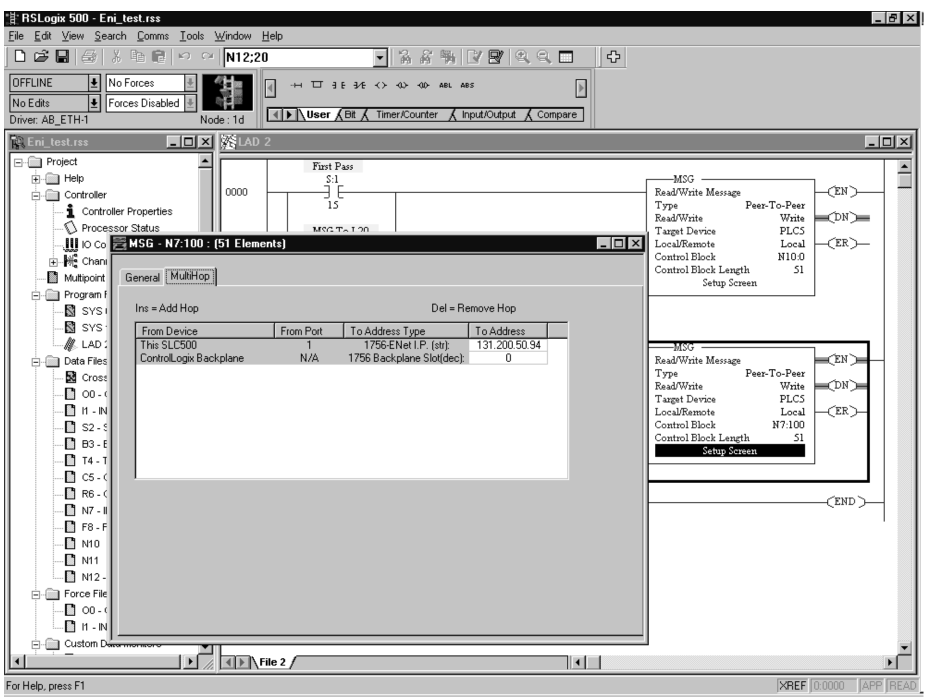



**SLC 5/05 Rung 0 MSG "Multihop" Tab**



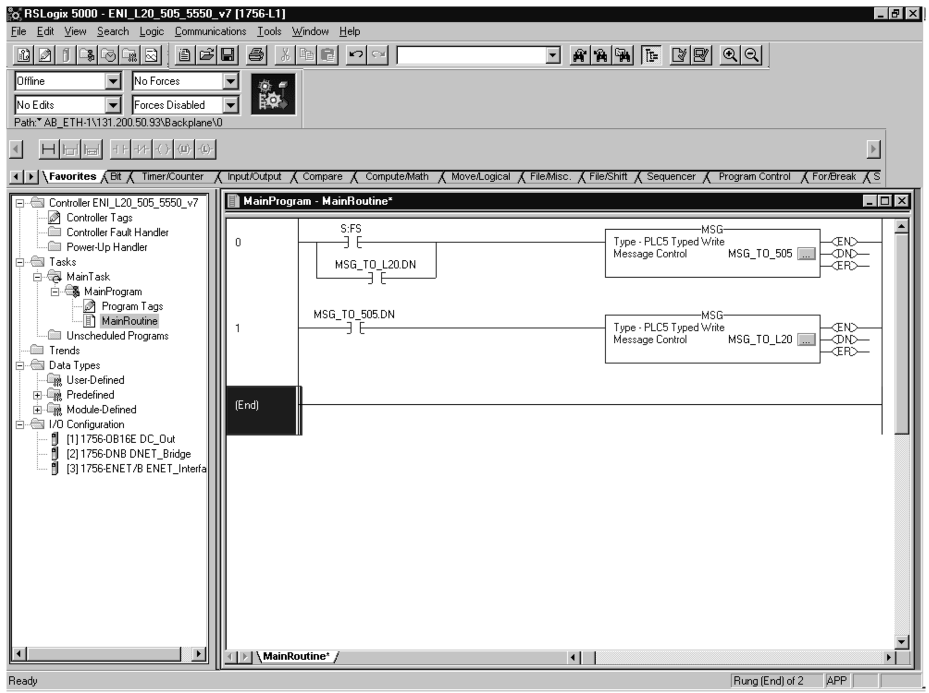
### SLC 5/05 Rung 1 MSG "General" Tab

### SLC 5/05 Rung 1 MSG "Multihop" Tab

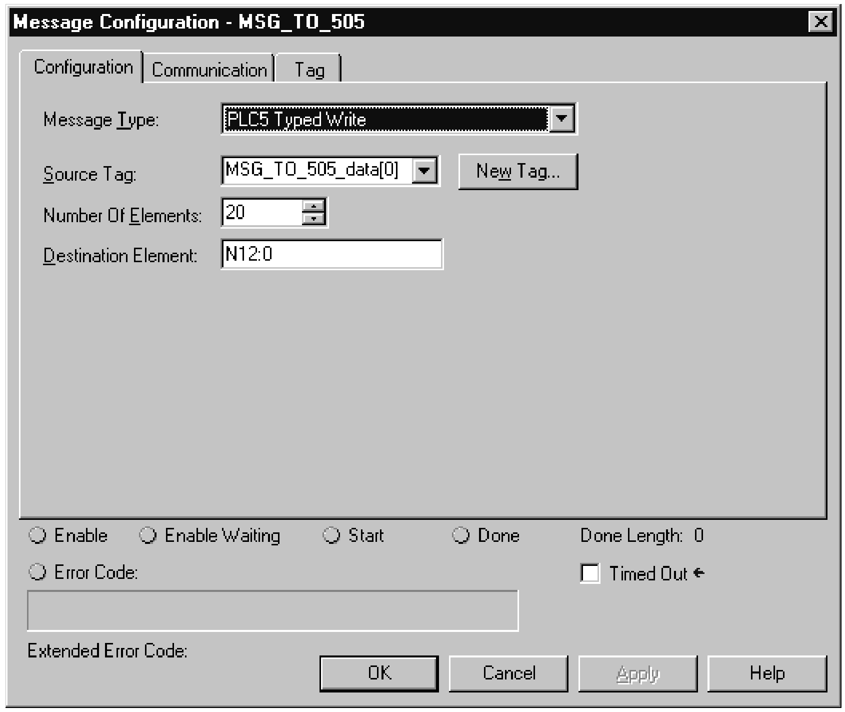


The following is the MSG ladder program for the 5550 controller, developed with RSLogix 5000. Following the ladder program are four additional screens showing the two tabs for each MSG Instruction. As part of your program, you must configure your 1756-ENET module with the proper IP address, subnet mask, and disable BOOTP.

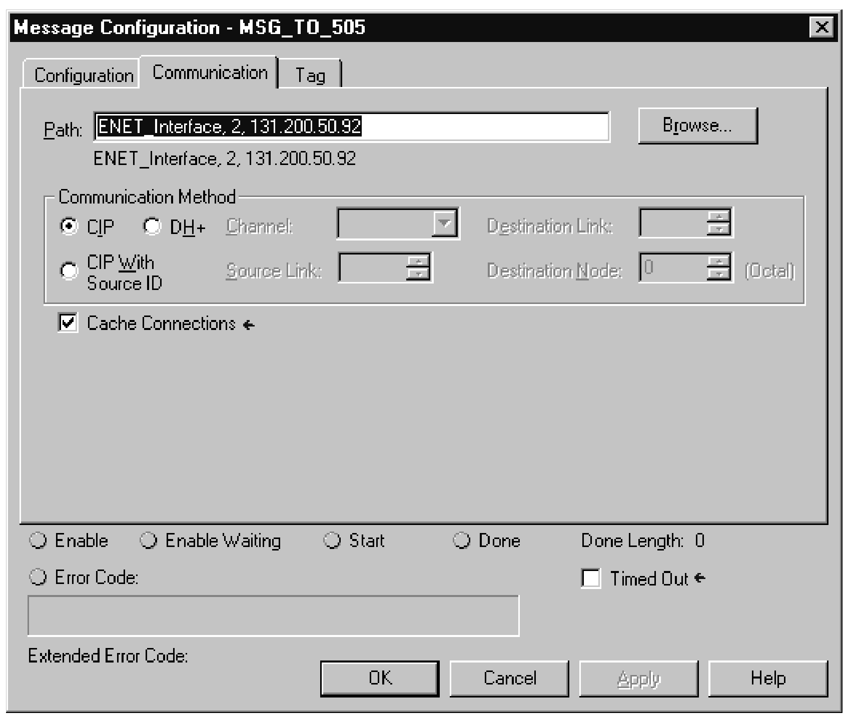
**ControlLogix 5550 Controller Ladder Program**



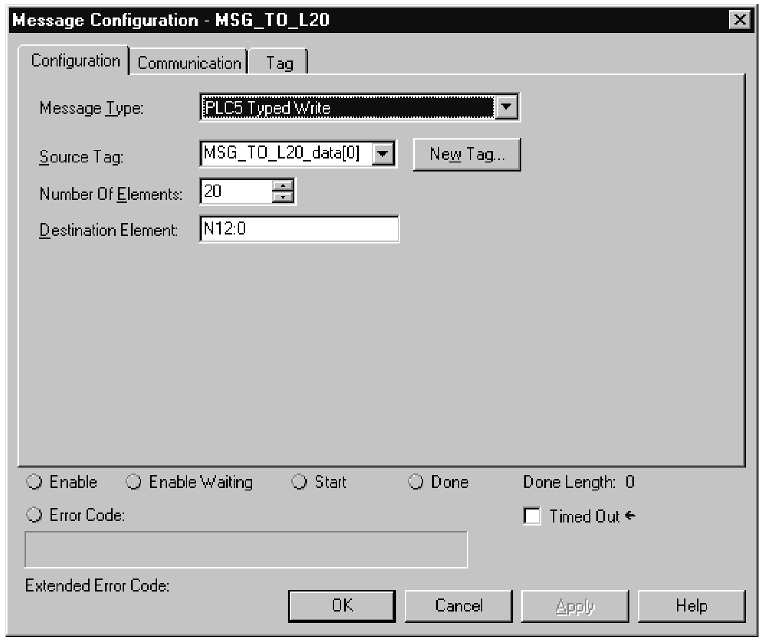
**ControlLogix 5550 Rung 0 Message Configuration Tab**



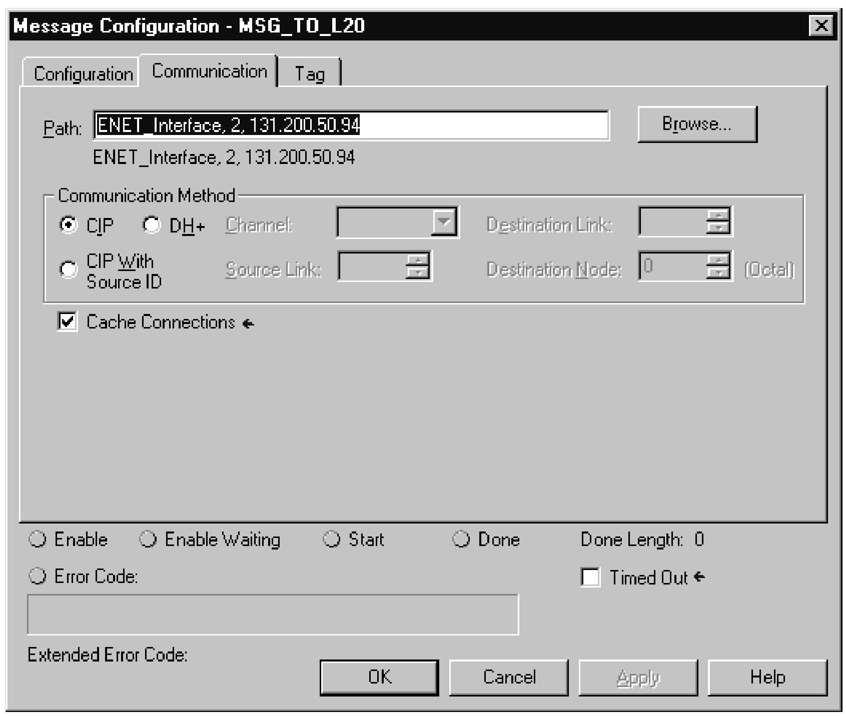

**ControlLogix 5550 Rung 0 Message Communication Tab**



**ControlLogix 5550 Rung 1 Message Configuration Tab**




**ControlLogix 5550 Rung 1 Message Communication Tab**

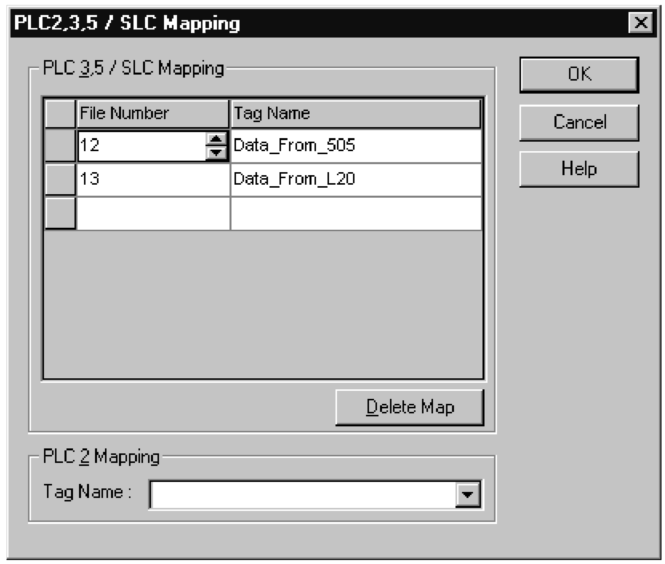



The 1761-NET-ENI modules do not support CIP commands. Therefore, all commands between controllers used in this application example are PLC_5 Typed Write commands. These commands require a PLC-5 type address to send the data to the receiving controller. Such

addresses do not exist in Logix controllers, so they must be mapped to existing tags in these controllers.

From the Logic pull down menu, select “Map PLC/SLC Messages”. Your mapped table for your 5550 program should look like the following:

**File Mapping for the ControlLogix 5550 Controller in RSLogix 5000**




Save your program.

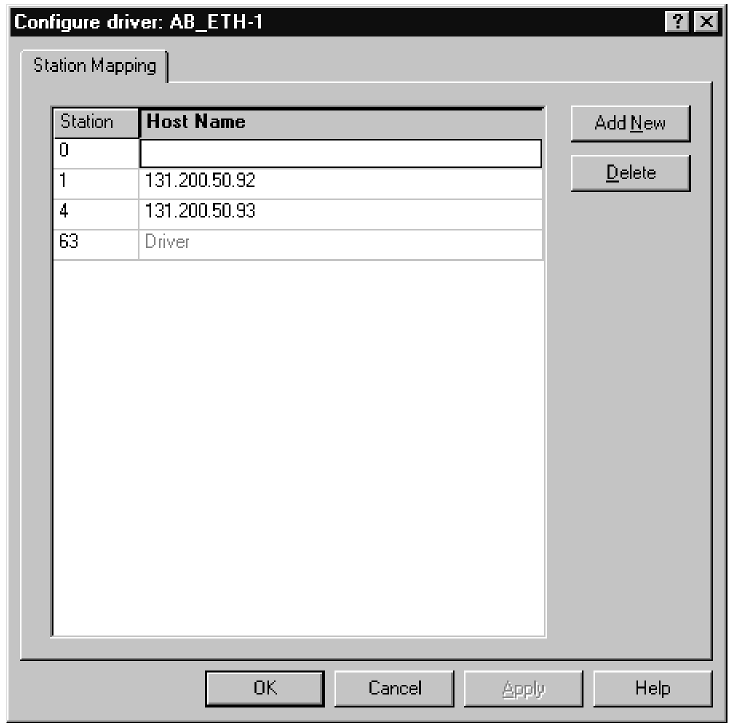
## Configuring an Ethernet Driver in RSLinx

In order to download your programs to the SLC 5/05 controller and to the 5550 controller via Ethernet, you must configure an Ethernet driver in RSLinx.

In RSLinx, click on the Communications pull-down menu and select Configure Drivers. Click on the arrow associated with the Available Driver Types box. Select Ethernet Devices, then click Add New.

Modify this screen to include the IP addresses of the SLC 5/05 and the 1756-ENET as shown below:

**Configure Ethernet Driver Using RSLinx**




From the RSLogix500 programming software, you should now be able to download your SLC 5/05 program. Then, from the RSLogix5000 software you should now be able to download your 5550 controller program.

Once all programs are downloaded to their respective controllers, place each controller into the RUN mode, and a MSG from each controller will be sent to each of the other controllers. Each controller will only send one MSG at any given time. Go online with the CompactLogix, SLC 5/05, and 5550 controllers to verify the successful completion of their Messages.

# Configuring I/O with the 1769 Generic or Thin Profiles

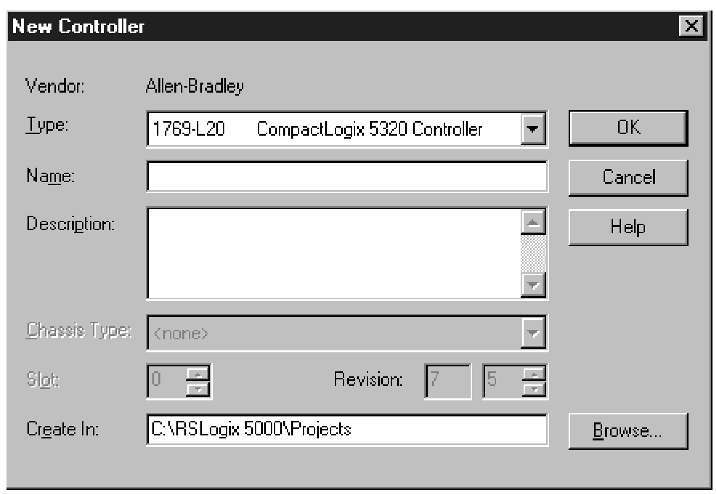
## Using This Appendix



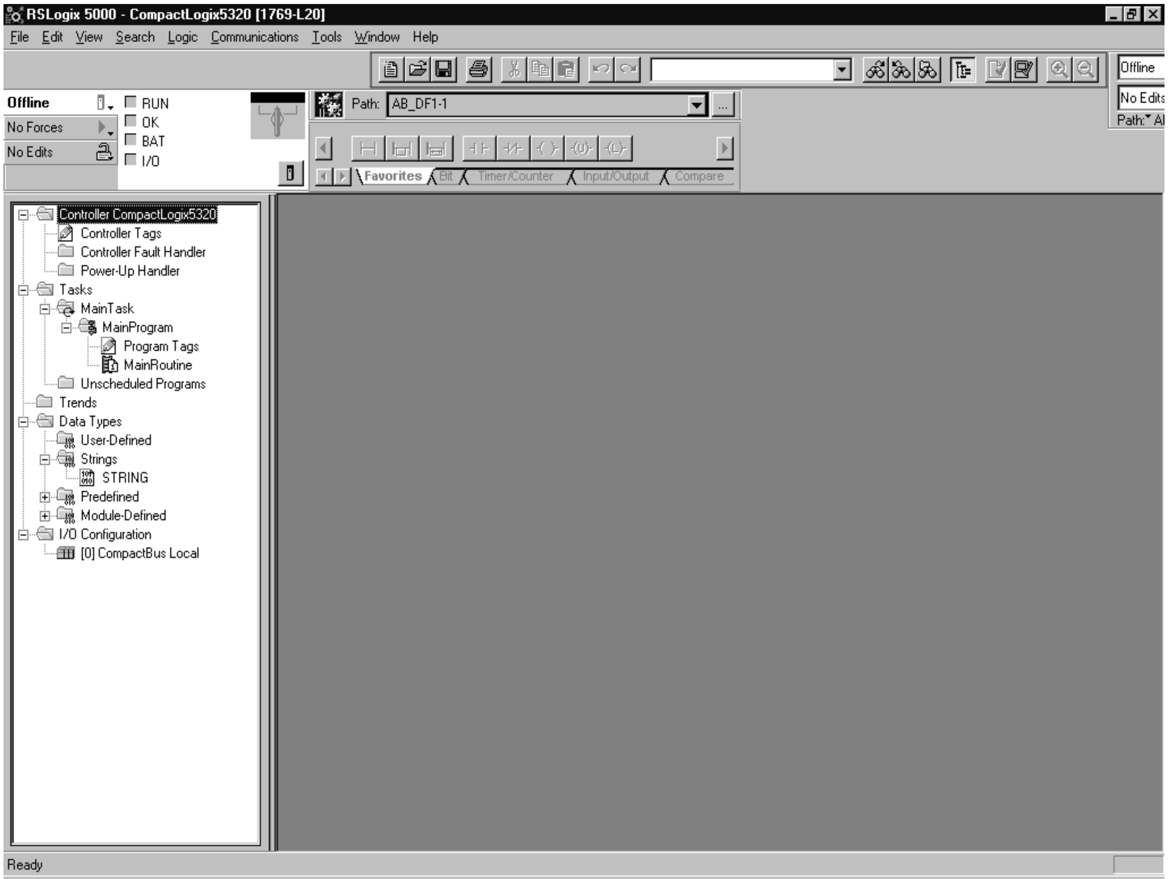
The following Generic or Thin Profile scenario is used only when a full 1769 I/O module profile is not available in RSLogix 5000 Programming Software. The initial release (version 7) of the CompactLogix5320 controller includes only the Generic Profile. The version 8 release of both RSLogix 5000 and the CompactLogix controllers supports Thin Profiles, with full module profiles to follow.

## Creating a Generic/Thin Profile

To configure a 1769 I/O module for a CompactLogix Controller in RSLogix 5000 using the Generic/Thin Profile, first begin a new project in RSLogix 5000. Click on the new project icon or on the File pull-down menu and select New. The following screen appears:



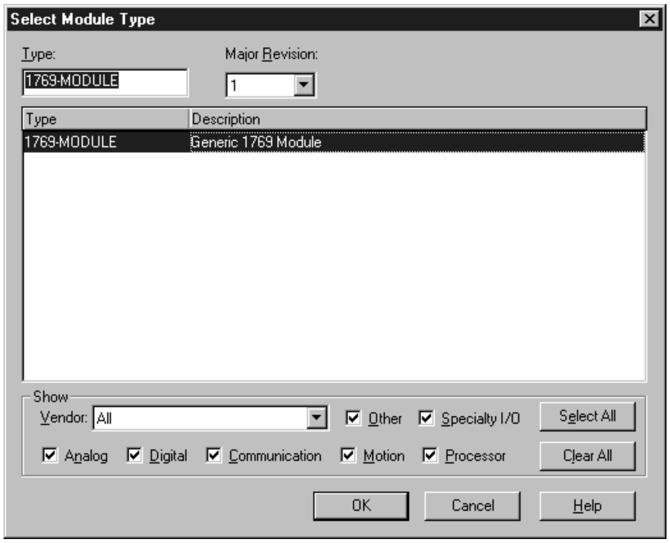
Choose your controller type and enter a name for your project, then click OK. The following main RSLogix 5000 screen appears:



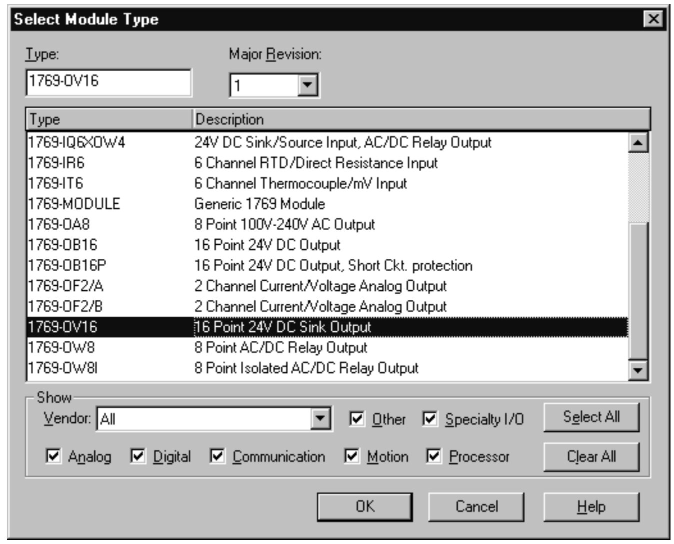

The last entry in the Controller Organizer on the left of the screen shown above is a line labeled “[0] CompactBus Local”. Right click on this line and select New Module.

One of the following screens appears, depending upon your version of RSLogix:

**RSLogix Version 7 - Generic Profile**




**RSLogix Version 8 - Thin Profiles**



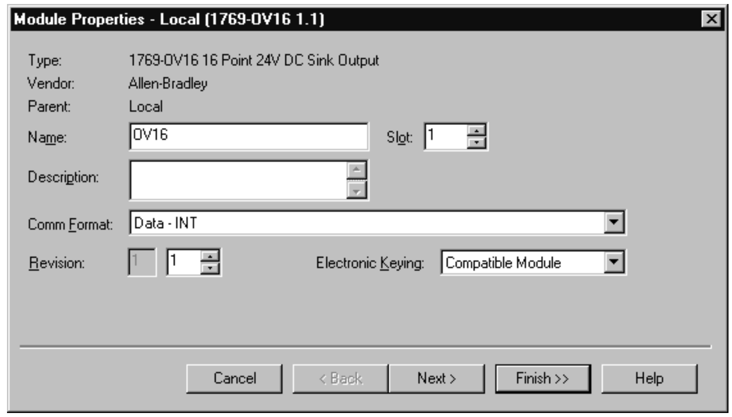

This screen is used to narrow your search for I/O modules to configure into your system.

| IMPORTANT | The initial release of the CompactLogix5320 controller included only the Generic 1769 Module. The version 8 release of the CompactLogix controllers supports Thin Module Profiles. See either Thin Profiles below or Generic Profile on page H-4. |
|---|---|

## Thin Profiles

Thin Profiles for each I/O module appear on the version 8 Module Type screen as shown above. Each I/O module merely needs to be

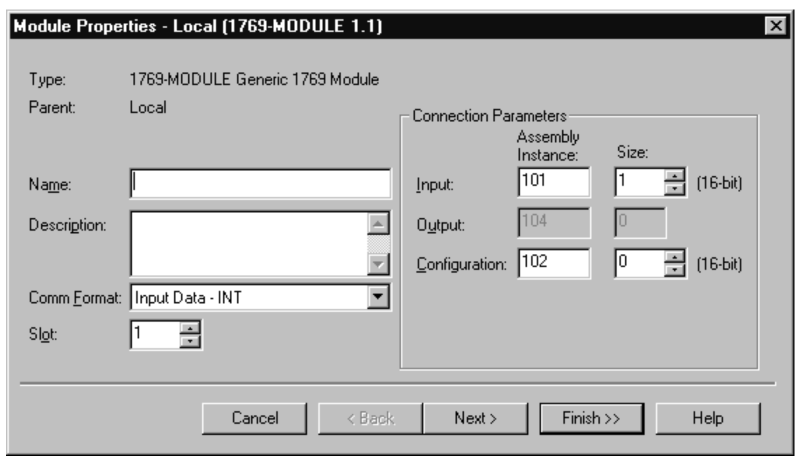
selected, named, and assigned a valid slot number. Descriptions are optional.




If you have version 8 of RSLogix 5000 and CompactLogix controller firmware, proceed to Completing the Module Profile on page H-6 once you have selected the Thin Profiles for your I/O modules.

## Generic Profile

For the Generic Profile, click the OK button, and the following default Generic Profile screen appears:




This is the default Generic Profile screen. First, fill in a name for your module. For this example, “OV16” is used for a 1769-OV16 module. This helps to easily identify the module type configured on your local CompactBus. The Description field is optional and may be used to provide more details concerning this I/O module in your application.

The next parameter is the Comm Format. Click the down arrow for this parameter to reveal the choices. For all 1769 analog output modules, discrete output modules, and discrete combination modules,

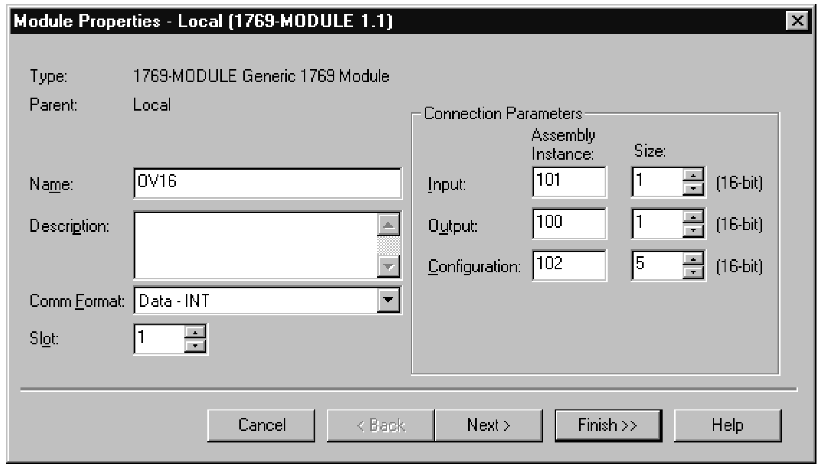
"Data – INT" is used. "Input Data – INT" is used for all 1769 analog input and discrete input modules. In this example, we create a Generic Profile for the 1769-OV16. The Comm Format is Data – INT.

Next, you must select a slot number. It begins with the first available slot number, 1, and increments automatically for each subsequent Generic Profile you configure. For this example, the 1769-OV16 output module is located in slot 1.

The Comm Format, Assembly Instance and Size values for all 1769 I/O modules are listed in the following table:

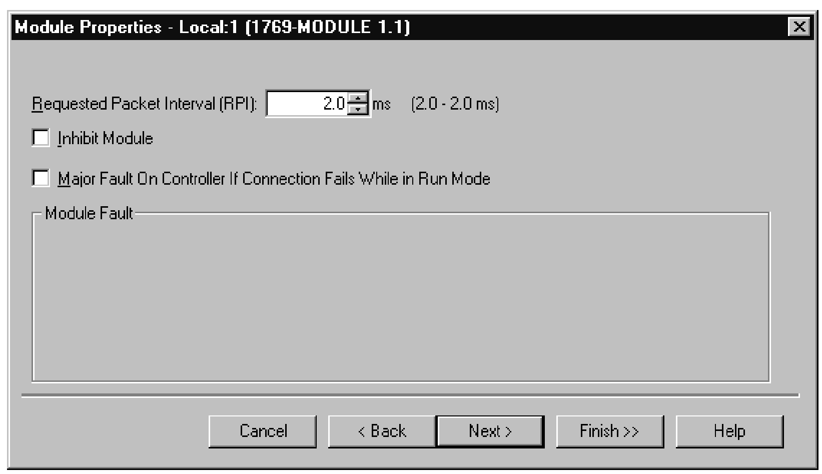
| 1769 I/O Modules | Comm Format | Parameter | Assembly Instance | Size (16-bit) |
|---|---|---|---|---|
| OA8, OW8, OB16, OV16, OW8I | Data - INT | Input<br>Output<br>Config | 101<br>100<br>102 | 1<br>1<br>5 |
| IA16, IQ16, IA8, IM12 | Input Data – INT | Input<br>Output<br>Config | 101<br>104<br>102 | 1<br>0<br>0 |
| IQ6XOW4 | Data – INT | Input<br>Output<br>Config | 101<br>100<br>102 | 2<br>1<br>5 |
| IF4 | Input Data – INT | Input<br>Output<br>Config | 101<br>104<br>102 | 6<br>0<br>4 |
| OF2 | Data – INT | Input<br>Output<br>Config | 101<br>100<br>102 | 4<br>2<br>8 |
| IT6, IR6 | Input Data – INT | Input<br>Output<br>Config | 101<br>104<br>102 | 8<br>0<br>8 |

Note the Comm Format, Assembly Instance numbers and their associated sizes for the 1769-OV16 module type and enter them into the Generic Profile. The Generic Profile for a 1769-OV16 should look like the following:




## Completing the Module Profile

At this point you may click Finish to complete the initial configuration of your I/O module. If you click Next, the following screen appears:



The RPI is fixed at 2 msec for the CompactLogix controller. You may choose to inhibit the module using this screen. The default is to not inhibit the module. See Inhibiting the CompactBus on page 3-5.

| | |
|---|---|
| **IMPORTANT** | The "Major Fault On Controller If Connection Fails While In Run Mode" option will not effect controller operation. The controller's response to a connection failure of any I/O module is fixed to always fault the controller. |

Please refer to the HELP screens in RSLogix 5000, under Connection Tab Overview for a complete explanation of these features.

Click Finish to complete the initial configuration of your discrete I/O module.

Create profiles for each I/O module in this manner. The CompactLogix5320 controller supports a maximum of 8 I/O modules. The valid slot numbers to select when configuring I/O modules are 1 through 8. The CompactLogix5330 controller supports a maximum of 16 modules, with valid slot numbers 1 through 16.

## Configuring I/O Modules

Once you have created Generic or Thin Profiles for each I/O module in your system, you must enter configuration information into the Tag database that has been automatically created from the Generic/Thin Profile information you entered for each of these modules. This configuration information is then downloaded to each module at program download, at power up, and whenever a module is inhibited and then uninhibited.

First, enter the Controller Tag database by double-clicking on Controller Tags in the upper portion of the Controller Organizer. In this section, we demonstrate entering configuration data for the 1769-OF2, and -IF4 modules.

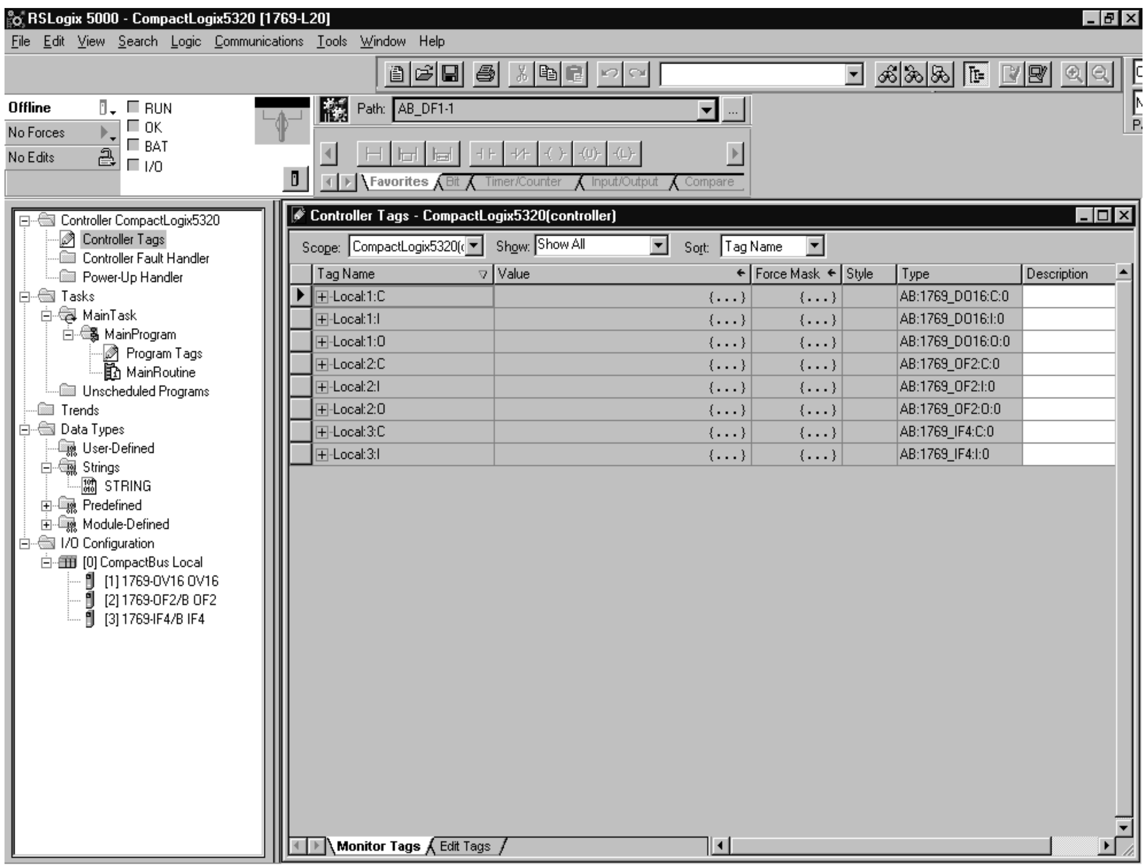
| | |
|---|---|
| **IMPORTANT** | Discrete output modules are not configurable at this time, because Hold Last State and User-Defined Safe State are not currently supported by CompactLogix controllers. Discrete input modules are also not configurable. |

For demonstration purposes, Generic Profiles have been created for 1769-OV16, -OF2, and -IF4 modules, located in slots 1 through 3, respectively.

**TIP**

These profiles could also have been Thin Profiles under version 8 of RSLogix 5000 and the CompactLogix controller.

As a result, the Controller Tags screen looks like the following:



Tag addresses are automatically created for configured I/O modules. All local I/O addresses are preceded by the word Local. These addresses have the following format:

Input Data: Local:*s*:I

Output Data: Local:*s*:O

Configuration Data: Local:*s*:C

Where *s* is the slot number assigned the I/O modules in the Generic Profiles.

In order to configure an I/O module, you must open the configuration tag for that module by clicking on the plus sign to the left of its configuration tag in the tag database.

## Configuring a 1769-OF2 Analog Output Module

To configure the 1769-OF2 module in slot 2, click on the plus sign to the left of Local:2:C. Configuration data is entered under the Local:2:C.Data tag. Click the plus sign to the left of Local:2:C.Data to reveal the 8 integer data words where configuration data may be entered for the 1769-OF2 module. The tag addresses for these 8 words are Local:2:C.Data[0] through Local:2:C.Data[7]. Only the first 6 words of the configuration file apply. The last 2 words must exist but both should contain a value of 0 decimal.

**TIP**

If you use Thin Profiles, each configuration parameter is listed by name, matching the configuration information in the module's user manual, *Compact I/O Analog Module User's Manual*, publication 1769-UM002A-EN-P.

The 8 configuration words for the 1769 analog output module are defined as follows:

| Word | Bit(s) | Definition |
|---|---|---|
| 0 | 0 | PFE0 – not used with CompactLogix systems |
| | 1 | not used – set to 0 |
| | 2 | PM0 – not used with CompactLogix systems |
| | 3 | FM0 – not used with CompactLogix systems |
| | 4 through 7 | not used – set to 0 |
| | 8 through 11 | Output Type/Range Select Channel 0 |
| | 12 through 14 | Output Data Format Select Channel 0 |
| | 15 | Channel 0 Enable Bit |
| 1 | 0 | PFE1 – not used with CompactLogix systems |
| | 1 | not used – set to 0 |
| | 2 | PM1 – not used with CompactLogix systems |
| | 3 | FM1 – not used with CompactLogix systems |
| | 4 through 7 | not used – set to 0 |
| | 8 through 11 | Output Type/Range Select Channel 1 |
| | 12 through 14 | Output Data Format Select Channel 1 |
| | 15 | Channel 1 Enable Bit |
| 2 | | Fault Value – Channel 0 (not used with CompactLogix systems) |
| 3 | | Program (Idle) Value – Channel 0 (not used with CompactLogix systems) |
| 4 | | Fault Value – Channel 1 (not used with CompactLogix systems) |
| 5 | | Program (Idle) Value – Channel 1 (not used with CompactLogix systems) |
| 6 | | Must be a value of 0 (decimal) |
| 7 | | Must be a value of 0 (decimal) |

The following is a description of each of the configuration parameters shown above. A more complete description of these configuration parameters may be found in the *Compact I/O Analog Module User's Manual*, publication 1769-UM002A-EN-P.

Words 0 and 1 contain identical functionality. Word 0 is for channel 0 and Word 1 is for channel 1. See below for a description of each of the parameters in Words 0 and 1.

**IMPORTANT** The CompactLogix controllers do not support the Hold Last State or User-Defined Safe State feature. Therefore, the Program to Fault Enable, Program Mode, and Fault Mode bits, as well as the Fault Value and Program (Idle) Value configuration words are not used. When the controller enters the Program Mode or faults, all analog outputs go to a value of 0.

*Output Type/Range Select:*

This selection allows you to configure each channel individually for various current or voltage ranges, per the table below:

| Output Range | Bit 11 | Bit 10 | Bit 9 | Bit 8 |
|---|---|---|---|---|
| -10V dc to +10V dc | 0 | 0 | 0 | 0 |
| 0 to 5V dc | 0 | 0 | 0 | 1 |
| 0 to 10V dc | 0 | 0 | 1 | 0 |
| 4 to 20 ma | 0 | 0 | 1 | 1 |
| 1 to 5V dc | 0 | 1 | 0 | 0 |
| 0 to 20 mA | 0 | 1 | 0 | 1 |

*Output Data Format Selection*

This selection configures each channel to interpret data presented to it by the controller in any of the following formats:

| Output Data Format | Bit 14 | Bit 13 | Bit 12 |
|---|---|---|---|
| Raw/Proportional | 0 | 0 | 0 |
| Engineering Units | 0 | 0 | 1 |
| Scaled For PID | 0 | 1 | 0 |
| Percent Range | 0 | 1 | 1 |

**TIP**

If ±10V dc is selected, the Percent Range output data format is invalid and if chosen, results in a configuration error.

*Channel Enable Bit*

Bit 15 of Word 0 must be set to a 1 to enable channel 0. Bit 15 of Word 1 must be set to a 1 to enable channel 1. Analog output channels are disabled by default.

Analog output data must then be written to tags Local:2:O.Data[0] and Local:2:O.Data[1] for channels 0 and 1, when using the Generic Profile. For the Thin Profile, the two data words are Local:2:O.Ch0Data through Local:2:O.Ch1Data.

## Configuring a 1769-IF4 Analog Input Module

To configure the 1769-IF4 Module in slot 3, click on the plus sign to the left of Local:3:C. Configuration data is entered under the Local:3:C.Data tag. Click on the plus sign to the left of Local:3:C.Data to reveal the 4 integer data words where the configuration data may be entered for the 1769-IF4 module. The tag addresses for these 4 words are Local:3:C.Data[0] through Local:3:C.Data[3]. The four configuration words apply to the four input channels respectively.

**TIP**

If you use Thin Profiles, each configuration parameter is listed by name, matching the configuration information in the module's user manual, *Compact I/O Analog Module User's Manual*, publication 1769-UM002A-EN-P.

The four configuration words are all identical, except that each applies to a different analog input channel. Word 0 applies to channel 0, word 1 applies to channel 1 and so on.

These configuration words are as follows:

| Bit(s) | Description |
|---|---|
| 0 through 3 | Input Filter Select |
| 4 through 7 | Reserved – set to 0 |
| 8 through 11 | Input Type/Range Select |
| 12 through 14 | Input Data Format |
| 15 | Channel Enable Bit |

### *Input Filter*

Each channel configuration word allows you to select an Input Filter on a per channel basis. The filter frequency affects noise rejection characteristics. Select filters based on a noise versus step response time trade-off. A 50 Hz filter will provide a high level of noise filtering, resulting in a 60 msec step response. In contrast, a 500 Hz filter will provide minimal noise filtering, resulting in a 6 msec step response.

The following table represents the input filter selections for the 1769-IF4:

| Input Filter | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|
| 60 Hz | 0 | 0 | 0 | 0 |
| 50 Hz | 0 | 0 | 0 | 1 |
| Not Used | 0 | 0 | 1 | 0 |
| 250 Hz | 0 | 0 | 1 | 1 |
| 500 Hz | 0 | 1 | 0 | 0 |

Refer to the *Compact I/O Analog Module User's Manual*, publication 1769-UM002A-EN-P, for more information on these filter selections.

### *Input Type/Range*

This selection allows you to configure each channel individually for various current or voltage ranges, as shown in the table below:

| Input Type | Bit 11 | Bit 10 | Bit 9 | Bit 8 |
|---|---|---|---|---|
| -10 to +10V dc | 0 | 0 | 0 | 0 |
| 0 to 5V dc | 0 | 0 | 0 | 1 |
| 0 to 10V dc | 0 | 0 | 1 | 0 |
| 4 to 20 mA | 0 | 0 | 1 | 1 |
| 1to 5V dc | 0 | 1 | 0 | 0 |
| 0 to 20 mA | 0 | 1 | 0 | 1 |

### *Input Data Format*

The following table provides the various data format selections for each of the analog input channels. For additional details concerning the formats shown below, refer to the *Compact I/O Analog Module User's Manual*, publication 1769-UM002A-EN-P.

| Input Data Format | Bit 14 | Bit 13 | Bit 12 |
|---|---|---|---|
| Raw/Proportional | 0 | 0 | 0 |
| Engineering Units | 0 | 0 | 1 |
| Scaled for PID | 0 | 1 | 0 |
| Percent Range | 0 | 1 | 1 |

**TIP** If ±10V dc is selected, the Percent Range output data format is invalid and if chosen, results in a configuration error.

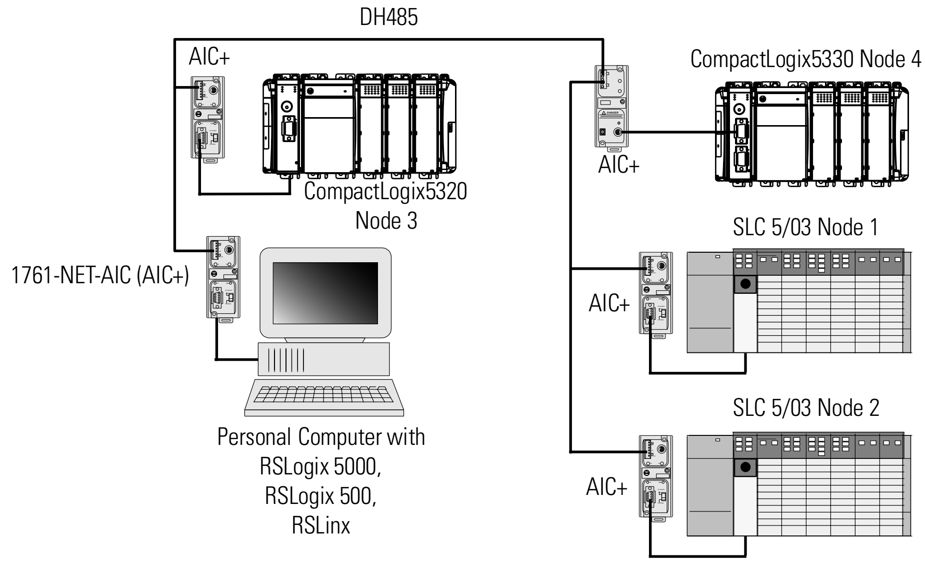
### *Channel Enable Bit*

Bit 15 in each of the four configuration words for the 1769-IF4 module is the Enable bit for each of the four analog channels. By default, all channels are disabled. To enable a channel, enter a 1 in bit 15 in the appropriate configuration word for that channel. Unused channels should be left disabled.

Analog Input data for the four analog input channels can then be found in tags Local:3:I.Data[0] through Local:3:I.Data[3], when using the Generic Profile. For the Thin Profile, the four data words are Local:3:I.Ch0Data through Local:3:I.Ch3Data.

# Messaging On DH-485 with SLC 5/03, CompactLogix5320 and CompactLogix5330 Controllers

**System Diagram**




**TIP** The 1761-NET-AIC (AIC+) at the computer may be eliminated if the computer is near enough to any one of the controller AIC+ units to connect with a 1747-CP3 cable.

This application example illustrates how to expand an existing SLC 5/03 control system application with the addition of two CompactLogix controllers. The SLC 5/03 controllers are connected together on a DH485 network, for messaging between them and for program upload/download and program monitoring with RSLogix500. The CompactLogix controllers also connect to the existing DH485 network for messaging between them as well as for messaging to the SLC controllers and for program upload/download and monitoring with RSLogix 5000.

## Scope

The two existing SLC 5/03 controllers are DH485 nodes 1 and 2. The CompactLogix5320 controller is node 3 and the CompactLogix5330 controller is node 4. The SLC 5/03 controllers are sending a message to each other, each reading 50 words from the other. The CompactLogix5320 controller will write 50 words of data to the CompactLogix5330 controller and will read 50 words of data from SLC 5/03, node 1. The CompactLogix5330 controller will write 50 words of data to the CompactLogix5320 controller as well as read 50 words of data from SLC 5/03, node 2.

All messaging is accomplished on the DH485 network. Each CompactLogix controller sends one message at a time, to keep the traffic on DH485 to a minimum. This allows the programming software to access the controllers more readily, while the system is running.

While online with one of the CompactLogix controllers with RSLogix 5000, message throughput between controllers on DH485 decreases. Take this into account when planning your system. If your system cannot tolerate decreased message throughput, do online edits and upload/download of programs on DH485 when the system is not running and the controllers are in Program Mode. If accessing the ladder programs is critical and decreased message throughput cannot be tolerated, CompactLogix5330 controllers which feature a second serial port, should be used. The controllers may then be accessed with RSLogix 5000 via the second serial port, and the DH-485 network will not be impacted.

The 1761-NET-AIC (AIC+) units connect to the serial port on a CompactLogix controller via a 1761-CBL-PMO2, series B cable, or a 1747-CP3 cable.

All messages for this application use SLC 500 Typed Read and Write commands. For consistency, even messages between CompactLogix controllers use the SLC commands. In that case, the receiving CompactLogix controllers must map the SLC command destination file address number to an internal tag. This is covered in detail later in this application example.

## Configuring and Programming the CompactLogix Controllers

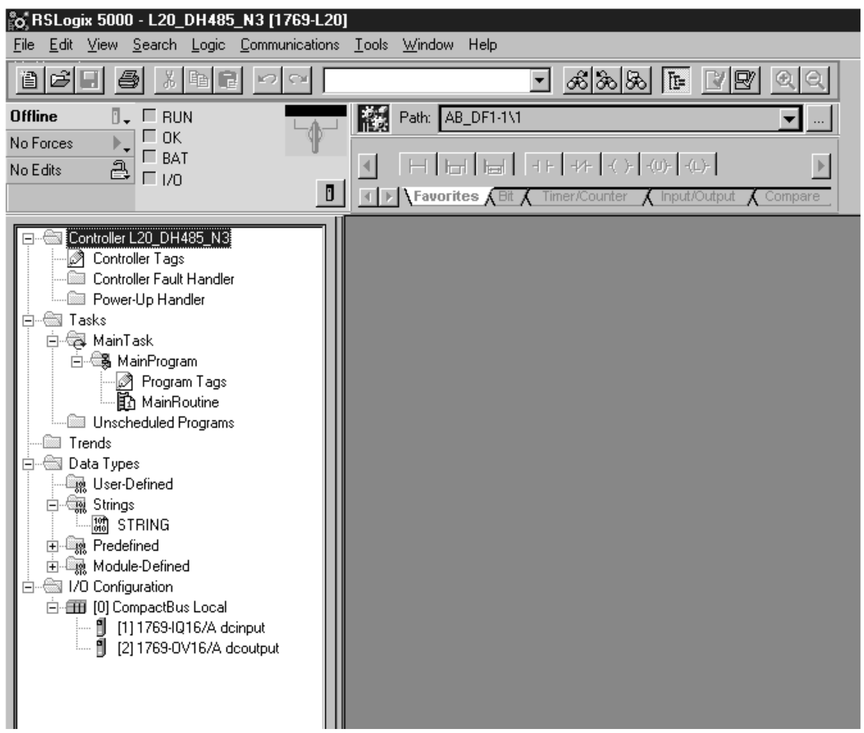
The ladder programs for the two CompactLogix controllers are quite simple for this application example, consisting of two MSG rungs. We also configure each controller’s channel 0 serial port for DH485 and map the file address of SLC 500 commands received to internal tags. Then, these controllers are added to the existing DH485 network with the SLC 5/03 controllers.

## CompactLogix5320 Controller

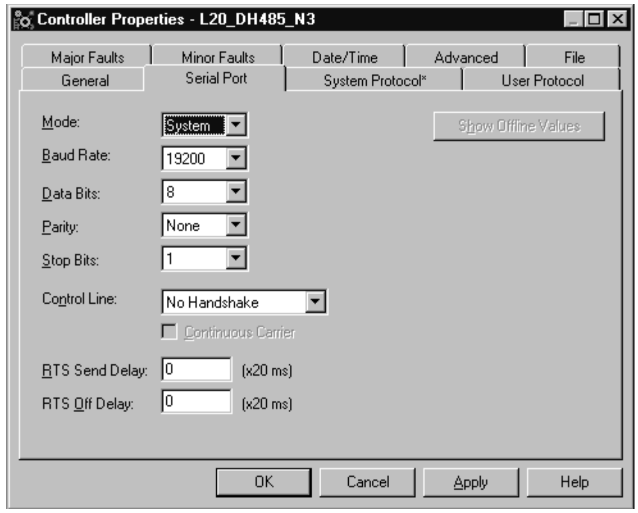
The CompactLogix5320 controller is assigned DH485 node address 3. The messages sent and received by this controller are as follows:

- Send a MSG to read 50 integer words from SLC 5/03 controller, node 1.
- Send a MSG to write 50 integer words to the CompactLogix5330 controller, node 4.
- Receive a MSG write of 50 integer words, from the CompactLogix5330 controller, to file 11. File 11 will be mapped to tag “data_from_L30_N4” in the CompactLogix5320 controller.

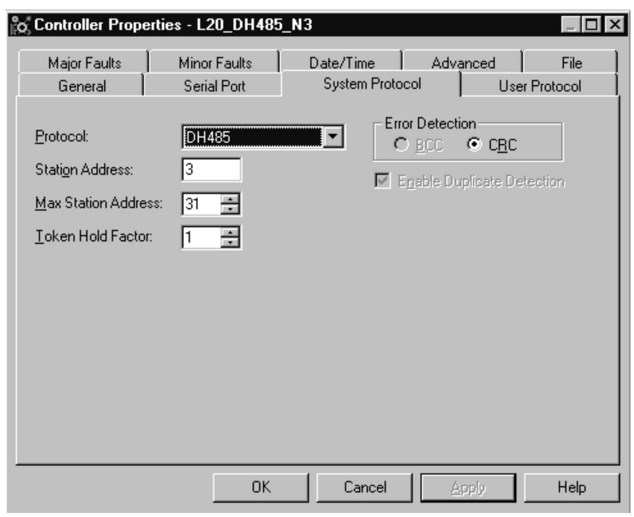
Start RSLogix 5000 by double clicking its icon. Then, open a new project and give it a name. The name used in this example is “L20_DH485_N3”. Your screen should look like the following:




The Controller Organizer is the area on the left of the screen. The first item at the top of the Controller Organizer is the controller, in this case named “Controller L20_DH485_N3”. Right click on the Controller and select Properties. In the Properties screen, click the Serial Port tab. This screen should look like the following:




Verify that your Serial Port tab for channel 0 looks like this. These are the default parameters. Then, click on the System Protocol tab. Select DH485 and a Station Address of 3. Your System Protocol screen should look like the following:

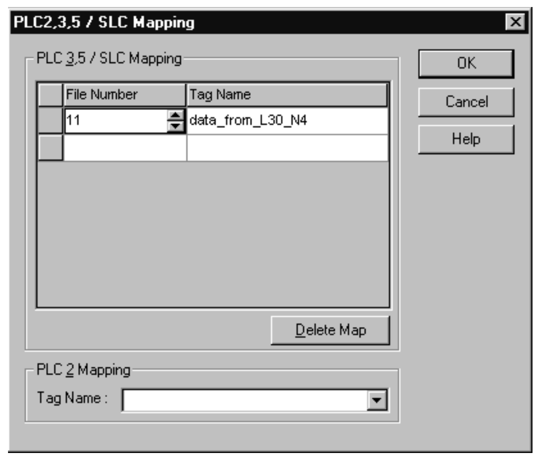



Click APPLY, then OK. The serial port for the CompactLogix5320 controller is now configured for DH485 and its node address is 3. Next, we will map file 11 to an internal tag. File 11 is the address used in the SLC 500 message from the CompactLogix5330 controller.

First we must create a tag of 50 integer words to put the data received from the CompactLogix5330 controller. Click on Controller Tags in the Controller Organizer. From the Controller Tags screen, click on Edit

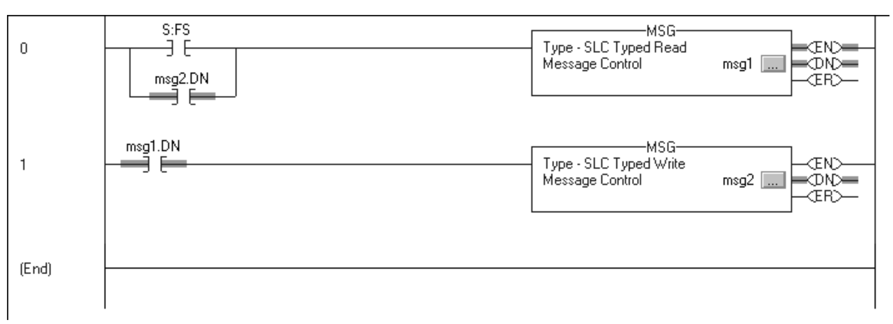
Tags at the bottom of the screen and enter a tag name consisting of 50 integer words. The tag name used in this example is “data_from_L30_N4”. When finished, click on Monitor Tags at the bottom of the screen to complete the creation of this 50 integer word tag.

Click on the “Logic” drop down menu and select “Map PLC/SLC Messages”. Enter 11 for the File Number and select tag “data_from_L30_N4” under the Tag Name field. Your screen should look like the following:



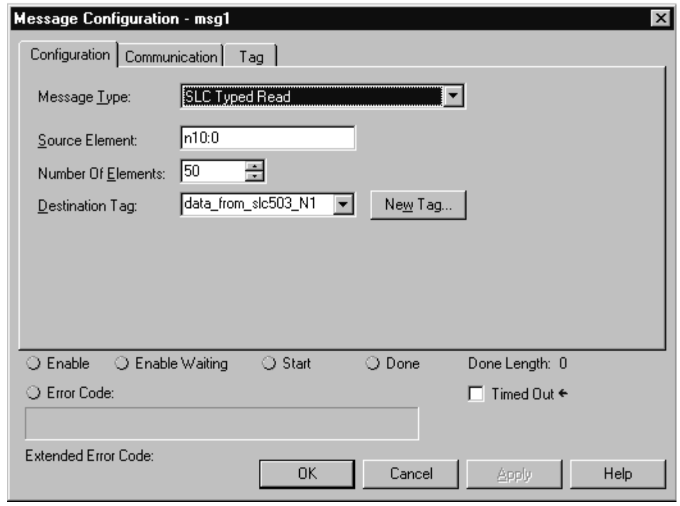

Click OK to accept and close this window. When a SLC 500 MSG is received from the CompactLogix5330 controller to write data to file 11, the data will be written to tag “data_from_L30_N4”.

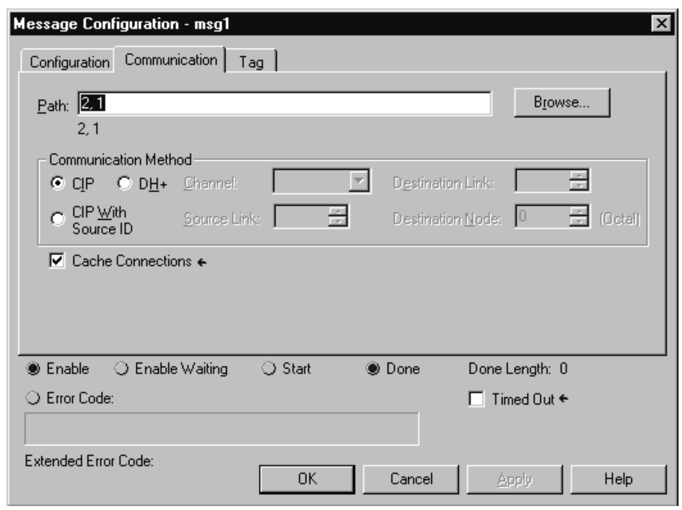
Next, we must enter our ladder logic, consisting of two MSG rungs. The program should look like the following:




The two messages toggle, allowing one message to be sent at a time. When it completes, the other message is triggered and so on. Two screens must be configured for each MSG Instruction. Since the first

message reads 50 integer words from SLC 5/03, node 1, its two screens should look like the following:



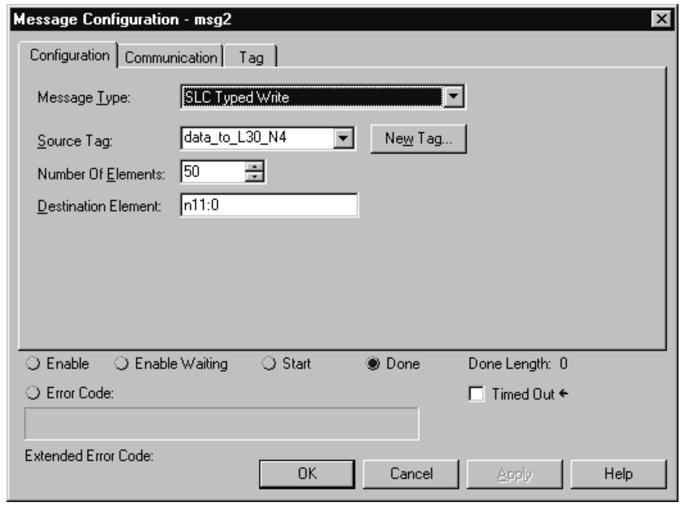



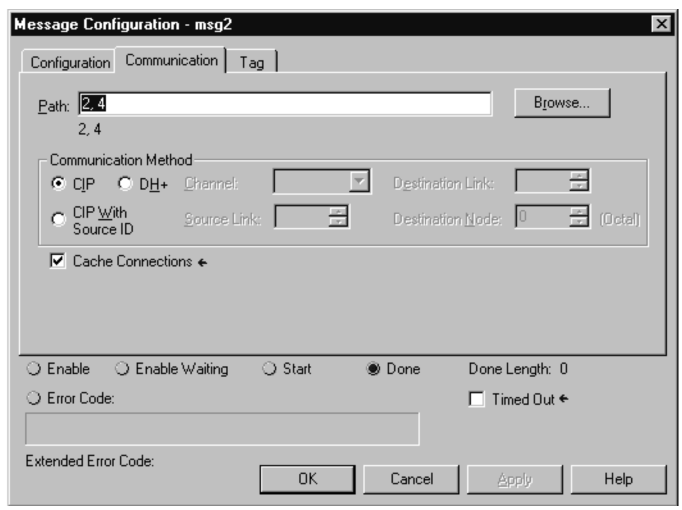

Notice that the 50 words of data are read from integer file N10:0 in the SLC 5/03 controller and stored in tag "data_from_slc503_N1". Also, notice that the path on the Communication tab is "2,1". Channel 0 is port 2 from the controller's perspective and the SLC 5/03 controller the MSG is being sent to is node 1.

**TIP**

The 2 in the Path shown in the screen above (2,1) directs the MSG to Channel 0 of the CompactLogix controller. Use 3 for Channel 1 of the CompactLogix5330 controller.

The second MSG Instruction writes 50 integer words of data to the CompactLogix5330 controller at node 4. Its two MSG Instruction screens should look like the following:




Notice that an SLC Typed Write message type is used to write 50 words of data to the CompactLogix5330 controller. The Destination Element of N11:0 will be mapped to a tag in the CompactLogix5330 controller as we did in the CompactLogix5320 controller. The data sent to the CompactLogix5330 controller is from tag “Data_to_L30_N4” in the CompactLogix5320 controller. The Path on the Communication tab is “2,4”, where the 2 represents channel 0 and the 4 is the DH485 node address of the CompactLogix5330 controller.

Save your program and download it to the CompactLogix5320 controller. You may download it to the CompactLogix5320 using the default protocol on this controller of full duplex DF1. In RSLinx, create a full duplex DF1 driver and use the Auto Config. feature to establish communications. Download the program from RSLogix 5000 and when you are prompted to apply the serial configuration changes, click Yes. The software displays a communication error, and you will be offline. The serial port is configured for DH485 and node address 3. You may now connect the CompactLogix5320 controller's serial port to a 1761-NET-AIC, which in turn may be connected to the DH485 network with the SLC 5/03 controllers.

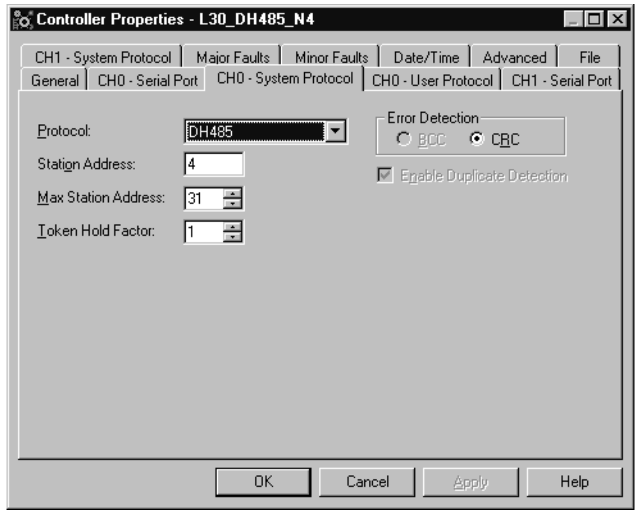
## CompactLogix5330 Controller

Repeat the same steps used to configure the CompactLogix5320 controller for the DH485 network, for the CompactLogix5330 controller.

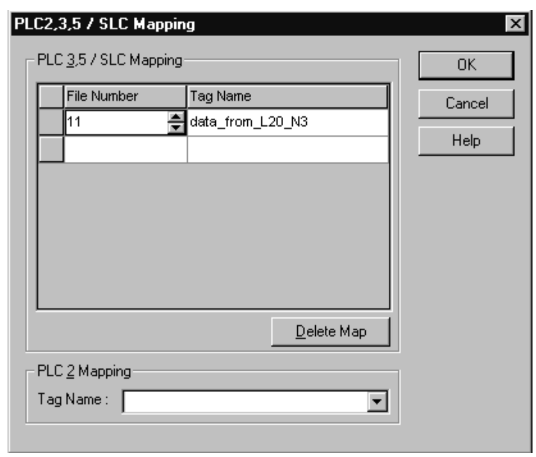
The CompactLogix5330 controller is assigned DH485 node address 4. The messages sent and received by this controller are as follows:

- Send a MSG to read 50 integer words from SLC 5/03 controller, node 2.
- Send a MSG to write 50 integer words to the CompactLogix5320 controller, node 3.
- Receive a MSG to write 50 integer words, from the CompactLogix5320 controller, to file 11. File 11 will be mapped to tag "Data_From_L20_N3" in the CompactLogix5330 controller.

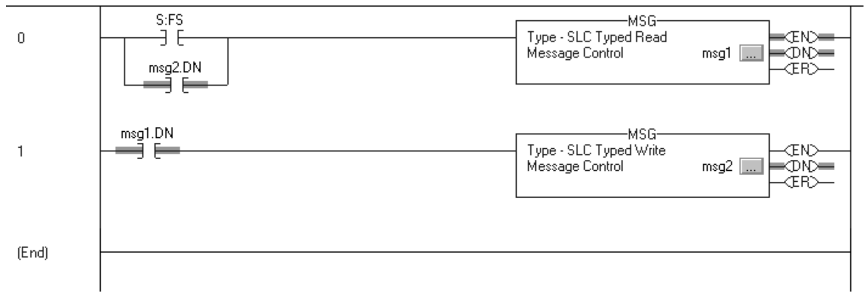
The Project name used in this example for the CompactLogix5330 controller is "L30_DH485_N4". The Channel 0 System Protocol tab should look like the following:



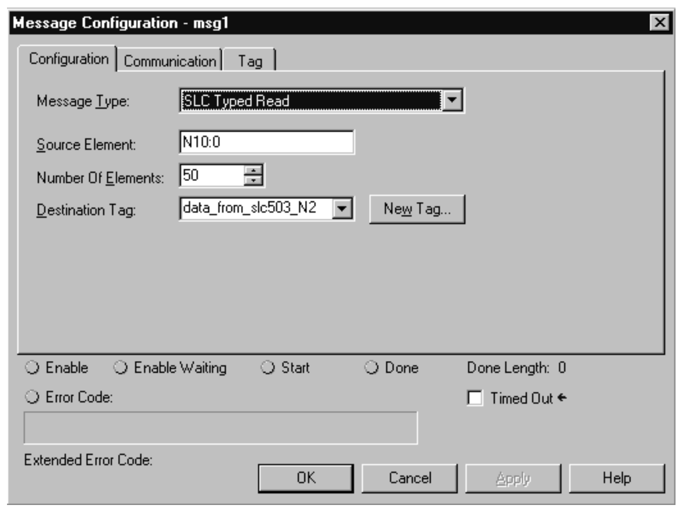

Next, create a 50 integer word tag in the Controller Tags for the CompactLogix5330 controller. The tag name used for this example is “data_from_L20_N3”. Then map file 11 to this tag name, as we did with the CompactLogix5320 controller. Your “Map PLC/SLC Messages” should look like the following:

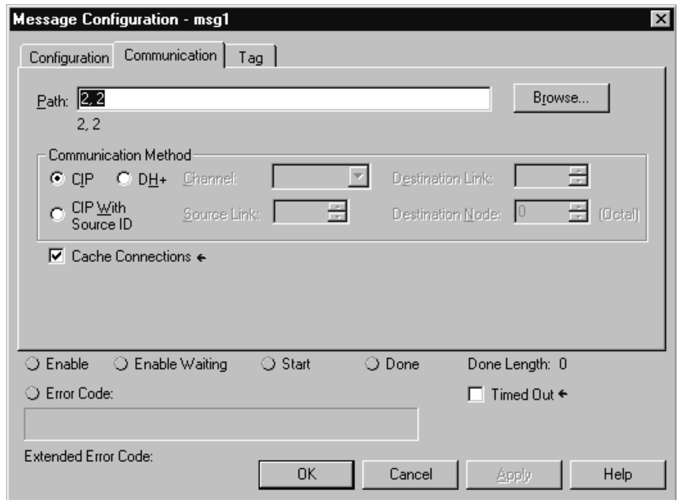


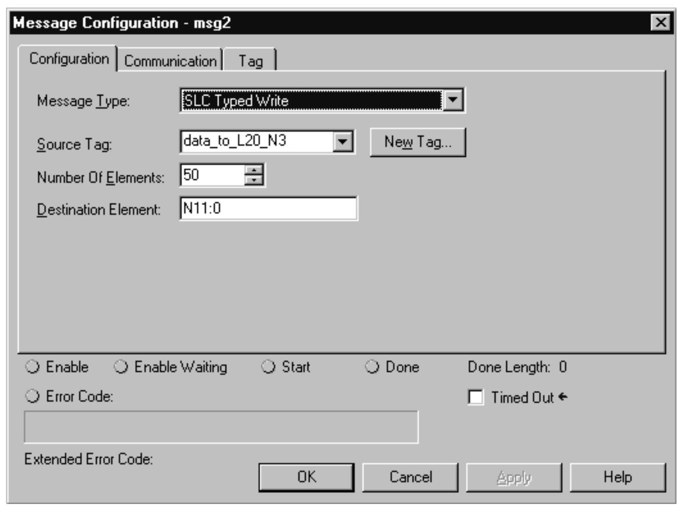

The ladder program for the CompactLogix5330 controller for this example consists of two MSG Instruction rungs, where the two messages toggle. The program looks like the following:

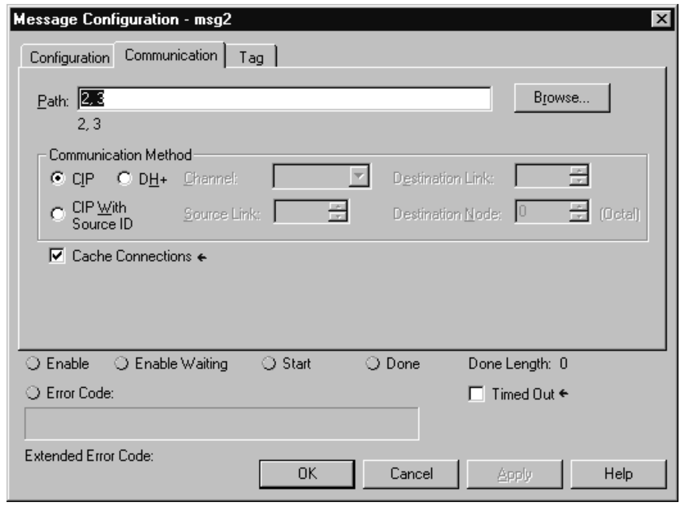



The MSG Instruction screens for the two MSG Instructions in the CompactLogix5330 program should look like the following:




Message Configuration - msg1
Configuration
Communication
Tag
Path:
2, 2
Browse...
2, 2
Communication Method
CIP
DH+
Channel:
Destination Link:
CIP With Source ID
Source Link:
Destination Node:
0
(Octal)
Cache Connections
Enable
Enable Waiting
Start
Done
Done Length: 0
Error Code:
Timed Out
Extended Error Code:
OK
Cancel
Apply
Help


Message Configuration - msg2
Configuration
Communication
Tag
Message Type:
SLC Typed Write
Source Tag:
data_to_L20_N3
New Tag...
Number Of Elements:
50
Destination Element:
N11:0
Enable
Enable Waiting
Start
Done
Done Length: 0
Error Code:
Timed Out
Extended Error Code:
OK
Cancel
Apply
Help




Save your program and download it to the CompactLogix5330 controller. You may download it to the CompactLogix5330 using the default protocol on this controller of full duplex DF1 on channel 0 or on channel 1. In RSLinx, create a full duplex DF1 driver and use the Auto Config. feature to establish communications. Download the program from RSLogix 5000. If you download to channel 0, you will be prompted to apply the serial configuration changes. Click Yes. The software displays a communication error, and you will be offline. The channel 0 serial port will be configured for DH485 and node address 4. You may now connect the CompactLogix5330 controller's channel 0 serial port to a 1761-NET-AIC, which in turn may be connected to the DH485 network with the SLC 5/03 and CompactLogix5320 controllers.

When the CompactLogix controllers are placed into the Run mode, they will begin sending MSGs.

**TIP**

If the combination of node count and network traffic on DH-485 makes it difficult or impractical to connect to your CompactLogix controllers with RSLogix 5000 while the system is running, it may be prudent to do program maintenance while the system is not running. Program upload/download, monitoring and online editing of programs on DH-485 may be more readily accomplished when the system is not running, i.e. the controllers are in Program mode.

In addition, when attempting to go online or upload/download a program using the Communications/Who Active window in RSLogix 5000, disable the Autobrowse feature to minimize traffic from RSLogix 5000 on the DH-485 network.

Another alternative is to switch to 1761-NET-DNI modules in place of the 1761-NET-AIC modules. The DNI modules use DeviceNet rather than DH-485. DeviceNet allows up to 64 nodes and a maximum data rate of 500K baud. DH-485 allows for up to 32 nodes and uses 19.2K baud.

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